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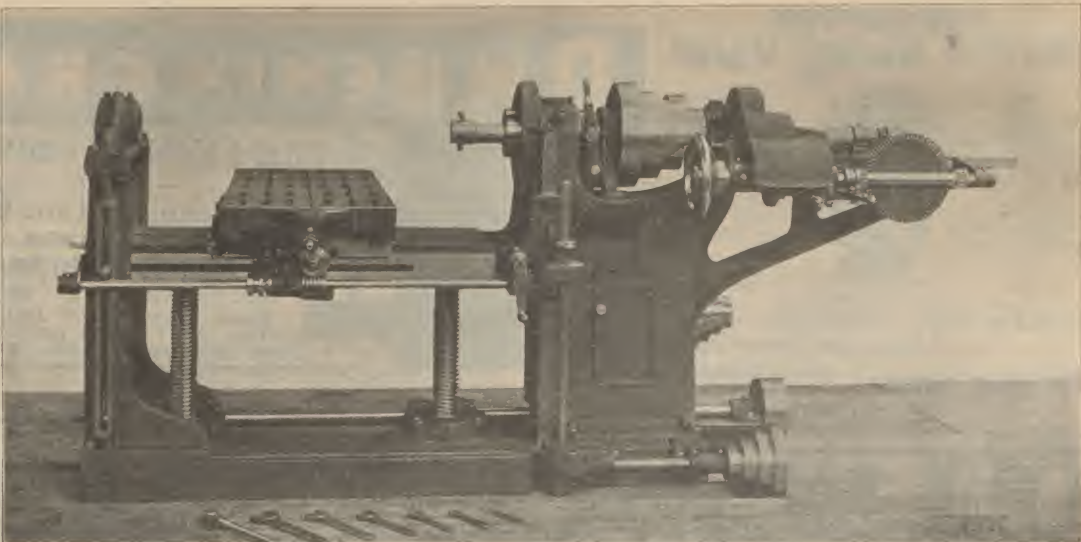
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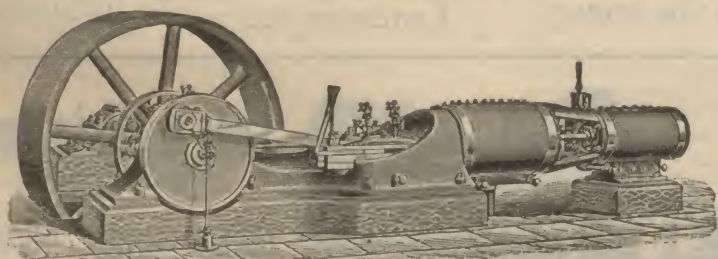
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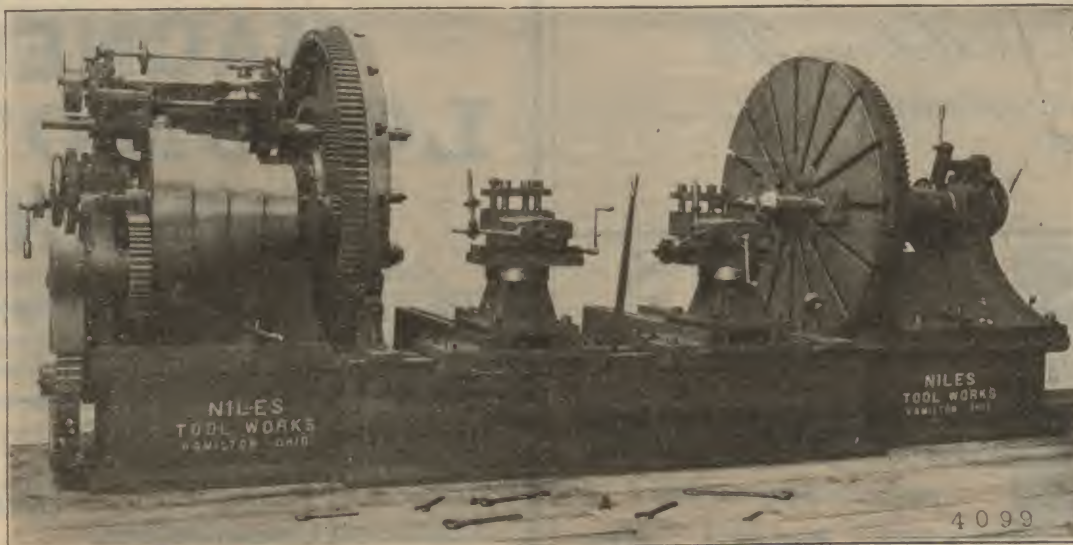


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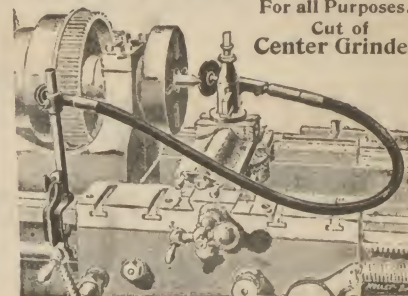
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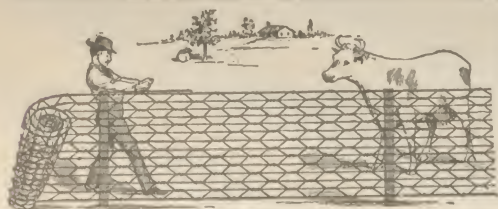
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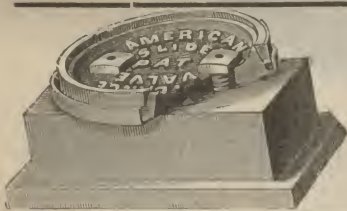
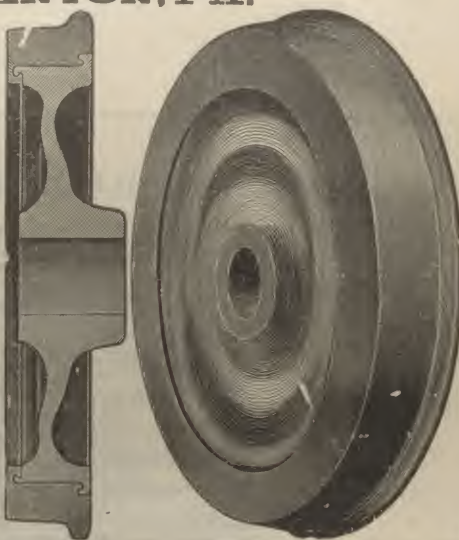
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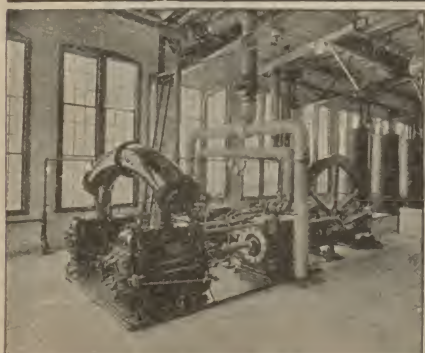


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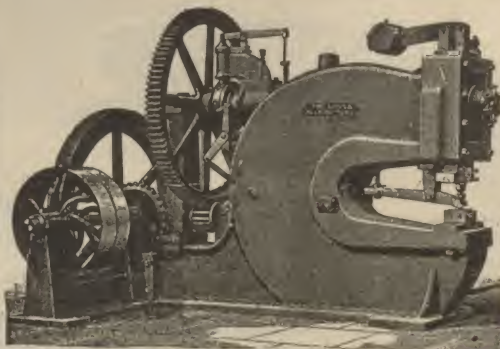
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THE RAILWAY REVIEW

No. 49

DECEMBER 5, 1896.

XXXV.

MOVING A FREIGHT DEPOT.—The largest building ever moved in this country was a freight warehouse of the Baltimore & Ohio Railroad in Baltimore. The building is 440 ft. long by 120 ft. wide and 60 ft. high. It is a wood and iron structure and was recently moved to make room for a new dock. The building contained a great quantity of freight, among which was 3000 cases of china and crockery, but not a dish was cracked in the moving. The men were engaged five weeks in making preparation for the move. On top of the old and new foundations were placed the sills or tracks upon which the building was to run. These tracks numbered forty, each consisting of two 6 x 12 in. timbers. On top of these were placed the 1000 rollers, each a piece of 5 in. pipe 3 ft. in length. There were 25 rollers to each of the 40 tracks. Between the top of the rollers and the floor beams of the building were arranged more of the 6 x 12 in. timbers; in all 6000 of the 6 x 12 in. timbers were used, each about 30 ft. long. The 225 wooden pillars which supported the warehouse were then sawed away and the structure rested upon the rollers. Along one side of the building were placed 45 ton screw jacks. They were braced against a railroad track, an adjoining warehouse and the tracks upon which the rollers ran. Two men stood at each jack. At a given signal each jack was given a quarter of a turn, moving the great building a fraction of an inch. Afterward the progress averaged two feet an hour for 5½ days. The structure arrived at its new foundation without a strained timber or a bolt. The jacks were again used in raising the warehouse enough to allow the removal of the timbers, after which it was lowered to the new foundation.

MANNESMANN STEEL BOTTLE TEST.—The public in general appears to have the idea that using compressed air stored at high pressures on street cars is dangerous. To prove how unfounded is this view, one of the bottles or tubes that is used in street cars was tested to destruction by hydraulic pressure on the 10th inst. by Charles G. Eckstein & Company of New York, at the works of Messrs. Watson & Stillman of New York. The bottle was marked off into seven equal parts and the measurements taken without pressure beginning at the bottom, were as follows: 2 ft. 5 1-16 in., 2 ft. 5 1-16 in., 2 ft. 5 1-16 in., 2 ft. 5 1-16 in., 2 ft. 5 3-32 in., 2 ft. 5 3-32 in., 2 ft. 5 1-32 in., outside diameter respectively. Length 5 ft., 6½ in. over all between perpendiculars. Under a pressure of 2,500 lbs. the greatest expansion was a little over 1-16 in.; at 4,000 lbs. 3-32 in. When this pressure was removed the bottle returned to its original measurements. At 4,350 lbs. the greatest expansion was ¼ in.; at 4,550 lbs. 7-32 in., and the greatest permanent set noticed was 6-32 in. At 5,000 lbs. the length of the bottle had increased nearly ¼ in., and the expansion was 7-16 in.; at 5,280 lbs. ¾ in., at 5,730 lbs., 13-16 in. The bottle burst under a pressure of 5,760 lbs. The fracture was very clean, and not even a minute particle of the metal flew. The fracture extended from the neck a distance of 2 ft. ¾ in. down the side of the bottle.

RAILWAY ECONOMICS.—A few days ago at the London (Eng.) School of Economics and Political Science, Mr. W. M. Acworth gave the first of a course of twelve weekly lectures on "Railway Economics". The lecturer in introducing the subject spoke of the need of technical education in railway matters as recognized in every country in the civilized world except England. He expressed the hope that before long in England instruction in railway questions would be recognized as one of the regular subjects under the technical education act, and referred to the necessity of keeping clear the distinction between what was done under systems of positive railway law in actual existence and what the abstract dictates of economic science would require. He then sketched out the course which he proposed to pursue in the series of lectures—first, to consider what was involved in the idea of a railway; secondly, to consider the theory of railway rates; thirdly, to consider the method in which rates, being what they were, could be best applied in the public interest, whether by state officials working a state owned system, or by private companies working in the interest of their dividend; and further, to consider the various methods by which in different countries the state exercised control over private management where it existed.

SAN SALVADOR RAILWAYS.—Recent advices from Salvador announce the completion of the work of extending the railway line from the port of Acajutla to Santa Ana, the commercial metropolis of the country. Until recently the road reached only as far as Ateos. The work of extension was begun in 1892 by Mr. A. J. Sherzer, under a contract with the government, and the occasion of its completion and public inauguration was celebrated with much official ceremony. The gage of the line is three feet and is equipped with steel rail of 54½ pounds. It is understood that the work of constructing the branch line to San Salvador, the national capital, has been undertaken by Mr. Sherzer, to be completed by next June.

TALL STEEL CHIMNEY.—The new steel chimney at the Ridgewood pumping station in Brooklyn, has been completed. It is said to be tallest structure of the kind in the country, and is visible from a great distance. The plates in the structure number 137, and vary in weight from 800 to 1,400 lbs., and in thickness from a quarter of an inch to a half inch. The tube is 217 ft. high with a diameter 20 ft. 7 in. at the base tapering to 8 ft. at the top. The braces on the inside consist of 205 iron rods, ¾ of an inch in diameter placed twelve inches apart. There is a filling in of brick for a distance of 108 ft. from the base to prevent injury from heat. The foundation for the chimney is 25 ft. square. On the concrete and brick foundation rest eight octagonal granite blocks weighing 6½ tons each. On these is placed a circular bed plate, which is fastened by twelve steel anchor bolts 22 ft. long and 2½ in. in diameter. The cost was \$10,000, and the chimney was put up in about half the time which would have been required in putting up a brick structure of equal dimensions. The chimney is to serve ten boilers of 250 horse power each.

A HIGH TEMPERATURE FURNACE.—At a meeting of the Philadelphia Franklin Institute of Nov. 17 a paper by Mr. H. L. Gantt on a new high temperature furnace was considered. Mr. Gantt's plan is to obtain temperatures higher than those of the Siemens furnace by heating the air for combustion to 3,000 deg. F. The furnace in question resembles the blast furnace inasmuch as it is a shaft furnace fired with coke and blown through tuyeres, but differs from the blast furnace in the use of regenerators instead of hot blast stoves. At the same time the regenerators are something more than is ordinarily included under that term, for in these chambers there is completed the combustion of the blast furnace gases, in which respect they resemble somewhat hot blast stoves. This, however, is as far as the resemblance goes. For the air used to complete this combustion in the regenerators is hot air, while in hot blast stoves it is cold. To obtain the conditions above enumerated Mr. Gantt proposes to build a Siemens regenerative furnace which has for the combustion chamber a shaft to hold the fuel and charge and one set of regenerators. If these regenerators are connected with each other by means of one or more passages near the top the hot air will be divided into two portions, one of which will pass through the furnace, promoting combustion therein, and the other will pass directly to the outgoing regenerator and complete in there the combustion of the carbonic oxide in the gas to carbonic acid.

ACETYLENE.—It is stated that if ordinary acetylene from carbide be passed through a series of three washing flasks containing a solution of sulphate of copper, there is no effect perceptible within three hours; but after twelve hours the first flask contains a black-brown, brilliant precipitate, the quantity of which goes on increasing for as much as eight days. This precipitate explodes on shock, friction, or heating; and it appears to be a mixture of phosphide and silicide of copper, of sulphate of cupro-acetylene, and a variable quantity of acetylides of copper. Its production appears to depend largely on the presence of ammonia in the crude acetylene gas; and it shows that the crude acetylene contains phosphuretted hydrogen and silicuretted hydrogen. The second flask contains a precipitate which is similar in appearance, but less explosive; and the precipitate in the third flask is not explosive. The explosive precipitate in the first flask will explode even under water, as, for example, when we try to rub it off the glass with a glass rod. As to the explosibility of acetylene there are two opinions. One that there may be metallic acetylides formed which act as detonators to the acetylene itself, so that acetylene cannot be used with reservoirs which are capable of being attacked by it; the other, that it can only be exploded when mixed with air, and that the influence of the outside explosions which can set it off cannot travel far through air. In any case, acetylene at a pressure not much exceeding that of the atmosphere is not explosive, though it is explosive at pressures above two atmospheres; so that there is no reason to fear an explosion through flame running back to a reservoir under a very small excess of pressure. Shock alone does not appear to cause explosion of the gas only of the acetylides. The alleged poisonousness of acetylene—which has not, as yet, given rise to any accident—would appear to be due to the occasional presence of cyanogen compounds, and is not a feature of pure acetylene. The presence of sulphuretted hydrogen in acetylene seems to depend on that of sulphide of aluminum in the carbide of calcium; sulphide of calcium may exist in it without forming this impurity. The blocking of gas jets by acetylene flames seems to be due to the formation of phosphoric acid. If oxygen be not present, acetylene does not attack copper; the oxide must be formed before the acetylide can be produced.

NEW DOCKS AT GIBRALTAR.—Consul Sprague notes that at Gibraltar: The continued increase of the British navy in battle ships and cruisers of formidable dimensions, is urging upon the government the necessity of establishing, without further delay, increased docking facilities for their new specimens for naval warfare, not only at home but in the colonies. Gibraltar has been one of the coaling stations which has already received the earnest attention of the admiralty, owing to its deficiency in dock and other accommodations for the refitting of war ships, besides securing protection from outward attack for the large stock of coal that has to be kept on hand. The construction of these formidable works has already commenced, with the employment of about 4,000 workmen

of all classes, who are daily kept hard at work, under the special charge of superintendents sent out from England by the admiralty authorities who control everything connected with this important undertaking, which is likely to consume at least five years for its completion and an outlay of several millions of pounds sterling.

GERMAN PILE DRIVING.—Mr. H. C. Carpenter, United States commercial agent at Furth, Germany, writing of the method employed in driving piles at that place says: A simple block-and-fall arrangement is rigged up over the pile and to the end of the rope, running through the pulley and fastened to the weight, are attached about twenty-five smaller ropes with hand pieces and twenty-five men grab these, and, at a signal from one of their number, all pull together. The weight goes up about eighteen inches or two feet, when the men relax their hold and the weight drops. It is unnecessary to state how long it takes by such a method to drive a pile or how much more effectually a small dummy engine would do the work. In the erection of building, the same tedious process is employed. Every stone to be raised requires the strength of a pair of horses and about fifteen men tugging away at the rope. The machinery manufactured and used in the United States for such purposes would do away with this clumsy method, but none of it seems to be in the market here.

A REMARKABLE STEEL CASTING.—The Penn Steel Casting & Machine Co., of Chester, Pa., cast the ram or stem post, on Saturday, Nov. 7, for the battleship "Kearsarge," now being built by the Newport News Shipbuilding & Dry Dock Co., for the United States government. Early on Saturday morning the two open-hearth furnaces, of 50 tons capacity, were charged with 45,000 pounds of metal each, to melt and pour the molds of this casting. This 90,000 pounds of metal was melted in 5½ hours. The furnaces were tapped at 5 o'clock p. m., and the metal was transferred to the two 25-ton ladles. These were hoisted by the large electric traveling cranes and placed over the runners of the mold, and in 30 seconds from the time the start was made to pour the ladles were empty. The casting has been taken out of the mold and cleaned, and is reported to be successful in every particular. The rabbets, made in the casting to receive the hull plating, are as perfect as the pattern. The casting is to be subjected to the annealing process, and then tested and inspected by the United States government inspectors stationed at the works of the Penn Steel Casting & Machine Co. This casting is considered by experts to be one of the finest that has been produced from open-hearth steel. It will weigh in the neighborhood of 70,000 pounds. [Engineering News.]

A GREAT FRENCH LIGHTHOUSE.—The penetrating powers and ranges of powerful lights, such as are employed in lighthouse service, rapidly decrease as the ratio of their luminous power increases. For instance, a light of 5,000,000 candle power in the British Channel has in average weather a luminous range of about 44 nautical miles, while if the light be increased to the power of 10,000,000 candle the luminous range is only five miles more, or 49 miles. According to current practice, lights up to 200,000 candle power are obtained by means of mineral oil lamps, while electric lights are used for higher powers, and almost any power may thus be obtained. The highest power yet attempted is about 36,000,000 at Penmark Point, in the department of Finisterre, France, which, when completed, will be the most powerful lighthouse illumination in the world. The light of the tower in which it is to be located is about 63 meters, enabling it to be seen during the day from a distance of 18 miles in fine weather. During the night this light will be visible for 60 miles. The rotundity of the earth will prevent the rays from striking the eye directly at a distance of more than 30 miles, but the sky overhead will appear illuminated for 30 miles more. The estimated cost of this lighthouse is about \$120,000.

The June Conventions for 1897.

The conventions of the American Railway Master Mechanics' and the Master Car Builders' associations for 1897 will be held at Old Point Comfort, Virginia, commencing on Tuesday, June 15, 1897. Headquarters will be at Hotel Chamberlain, which has made rates as follows to all those in attendance at the convention:

Single room, one person, without bath,	\$3.00 per day.
Single room, one person, with bath,	4.00 "
Double room, one person, without bath,	4.00 "
Double room, one person, with bath,	5.00 "
Double room, two persons, without bath,	3.00 " each person.
Double room, two persons, with bath,	4.00 " each person.

Members of the association will have preference of rooms at Hotel Chamberlain until March 1, 1897. Applications should be made to Geo. W. Swett, manager, Hotel Chamberlain, before that date in order to be sure of such accommodations.

The Hygeia Hotel, which is directly across the street from Hotel Chamberlain, has made the same schedule of rates and the same general terms. Parties wishing to secure rooms at this hotel should make application to F. N. Pike, manager, Hygeia hotel.

Messrs. R. H. Soule and S. A. Crone constitute a joint committee of arrangements.

TRACK DEPRESSION IN NEWTON, MASS., BOSTON & ALBANY RAILROAD.

The Boston & Albany Railroad is engaged upon an extensive piece of work in connection with the City of Newton, Mass., which has for its object the elimination of grade crossings within the limits of that city. When completed there will be no grade crossings upon the main line between Boston and Riverside, a distance of about ten miles. The tracks are to be laid in an open subway with sloping sides and paved gutters. The work necessitated an extensive change in the location of streets which run parallel to the tracks, and for this and other reasons, the cooperation with the city was necessary for carrying out the plans. The general character of the completed work will be seen by the accompanying illustrations which show sections at different points along the work. Fig. 1 shows a section of Walnut street and includes Washington street as well as the railroad tracks. Fig. 2 is a section at Parsons street, and Fig. 3 is a section between Washington and

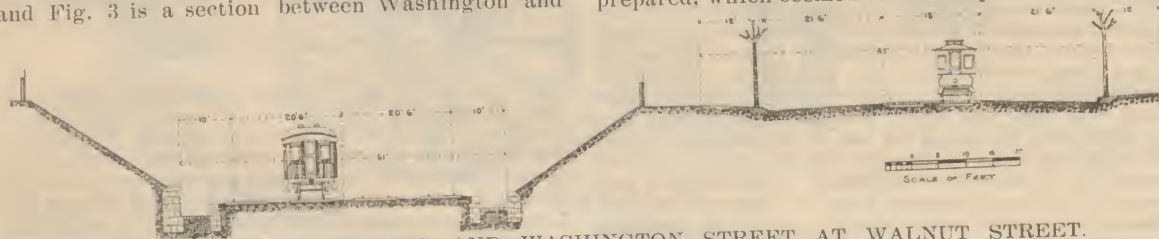


FIG. 1.—SECTION OF TRACKS AND WASHINGTON STREET AT WALNUT STREET.

Center streets. In the latter section Margin street is shown at the left of the tracks. We are indebted to Mr. H. D. Woods, city engineer of Newton for the information concerning this work, and for the drawings from which the illustrations were prepared. These were taken from his annual report to the city for the year 1895, which has recently been published.

"The question of widening Washington street and the abolition of the grade crossings on the Boston & Albany R. R. through Newton, which for a considerable distance is contiguous and nearly parallel to the street, have been under consideration for some time.

"The abolition of the grade crossings on the main line of the Boston & Albany Railroad, through the Newtons, has been before the public for several years. In 1889 a state commission made a report on "The General Abolition of Crossings of Highways at Grade by Railroads." The commission recommended a

subway with sloping banks was advocated: and to overcome the chief objection to this method of abolishing the grade crossings, he proposed taking all the land lying between Washington street and the railroad for the greater part of the distance, and giving the railroad a temporary location thereon while the depressing of the tracks went on.

"The Boston & Albany Railroad Company had assured the mayor of its approval of his plan and its readiness to cooperate with the city in asking for legislation authorizing the city and the railroad to execute the work in accordance therewith. The city council unanimously approved of the recommendations of the mayor, and the railroad and the city agreed upon an act, which was passed by the legislature and became a law on March 30, 1895.

"Various plans were made on this basis; and after many conferences between the president and the chief engineer of the Boston & Albany Railroad, and the mayor and the city engineer, a general plan was prepared, which seemed satisfactory to both parties.



FIG. 2.—SECTION AT PARSONS STREET.

partial elevation and a partial depression of the tracks through Newton. In 1893 a commission appointed by the city of Newton reported in favor of elevating the tracks as far as Auburndale. At a public hearing on June 30, 1894, considerable opposition was developed against the elevation of the tracks, forming a viaduct at the foot of the main line of hills through the city. It seemed to be the general feeling that the tracks ought to be depressed. The difficulty of the railroad depressing its tracks while maintaining the traffic on the present location, besides the objection of the traveling public to passing through a deep cut with side walls, seemed a great barrier in the way of obtaining this result: and for a while the matter was dropped.

Washington street is the main highway through the north part of Newton, between Wellesley and Weston on the west end, and Watertown, Cambridge

pay the city for the necessary land. By agreement the city was to furnish the railroad, free of cost, with a location for the two temporary tracks on the north side, over which trains could be run during the work of the depression. This land would eventually revert to the city and form part of the street. Where necessary land would be taken on the north side of Washington street.

"In order to raise the streets over the railroad as little as possible, and cause as least damage to the adjacent lands, the railroad endeavored to depress the tracks all that could be done without interfering with the matter of drainage. It was therefore decided to lower the brooks which crossed the railroad, as much as practicable, and thus limit the amount of the possible depression of the tracks.

"In order to depress the tracks and have ample room for the removal of snow, it was decided to place

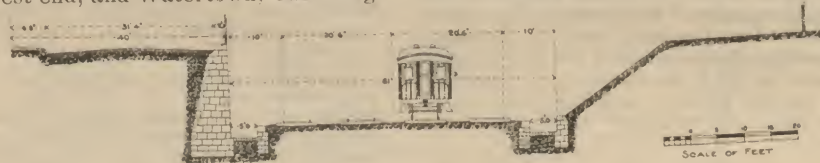


FIG. 3.—SECTION BETWEEN WASHINGTON AND CENTER STREETS.

and Boston on the east end. The width of the street varies in the different sections from barely 37 ft., between property lines near Church street, Newton, and Brookside avenue, Newtonville, to 65 ft. near Brighton hill, and 60 ft. near Woodland park and Commonwealth avenue, Auburndale. Both sides of the street are pretty closely built up through the villages of Newton, Newtonville and West Newton, making it necessary to move or destroy a large number of the buildings on whichever side the street was widened. Various plans had been considered to obtain the desired result, but no real progress was made in the matter until this year.

"The mayor presented a new and comprehensive plan in which the depression of the tracks in an open

the ditch wall—that is, the outside wall of the drainage ditch on either side of the tracks—10 ft. from the nearest rail. The railroad sections for depressed tracks are 3 ft. wider than the present construction. It was also found necessary, in order to utilize the present stations and to avoid as much rock blasting as possible, to move to tracks somewhat to the north in various places. The maximum movement is some 19 ft. from Mt. Vernon St. to Walnut St. This necessitated taking rather more land on the north side of Washington St. In places the slopes and temporary tracks will take up about all the present width of Washington street, and while the work is being done on the railroad street traffic will all have to be on the widened portion of the street. For this reason a

temporary sidewalk but six feet wide will be built on the north side of the street, which will eventually be widened out to twelve feet when the work is completed.

"When completed the roadway of Washington street, from West Newton to Hall street, will be 61 ft. wide, with a 12 ft. sidewalk on the north side. Where the railroad is contiguous to the street the electric cars will be placed on the south side, and there will be a 6 ft. walk next to the railroad fence for the use of the travelers on the electric. Where there are buildings left on the south side of the street there will be a 12 ft. sidewalk also.

"The accompanying plan and sections will give a general idea of the condition of things after the street is widened and the railroad depressed. It is proposed to have several new railroad crossings and bridges. There will be a bridge at Richardson street, one at Lewis terrace to take the place of the Bellevue street bridge; Bellevue street will be carried down to Church street on the south side of the track, a bridge has been arranged for at Lowell and Appleton streets, one at Felton street to take the place of Greenwood avenue crossing, and one at Putnam street, West Newton.

"Work was commenced on Washington street, near Bellevue street, about September 7, 1895. As the grade of the street has to be changed in various places, and new drains laid, it was deemed advisable also to lay sewers wherever they are likely to be required. Those portions of the streets which will have to be raised on account of the abolition of the grade crossings have not been disturbed, awaiting the order of the court with reference to the matter, as only a portion of this expense is to be borne by the city in these cases.

"As fast as the orders for laying out were passed the owners were notified to remove their buildings and other property. The first house was moved October 10. Since then the work of removing the buildings and filling up cellars has been carried on as fast as consistent with general convenience and economy.

"The work of widening has been carried on specially in those sections where the railroads will require a part of the present street either for slopes or for the temporary tracks.

"Up to December 31, 1895, \$33,871.71 had been spent in the widening of Washington street, and \$266,584 for settling damages."

PROFESSIONAL ETHICS AMONG ENGINEERS.*

By facilitating the interchange of professional experience, by promoting the discussion of professional subjects, and by distributing among their members the information thus obtained, our leading societies have made themselves factors in the progress of engineering. They should, however, discourage, and if possible, suppress any practices among engineers which are not strictly in accord with the highest standard of ethics. The engineers' conceptions of right or wrong cannot be modified to suit his own interests nor excused on the ground of professional license. Unfortunately, the keenness of competition in business has had a tendency to develop practices only slightly removed from dishonesty, but which are sometimes excused and even praised under the name of business sagacity and shrewdness. One of the practices which has become especially prevalent, and which demands heroic treatment for its eradication, may be explained by this example:

The engineer of a certain transportation company submits to several firms of contractors the problem of delivering merchandise from steamers and cars to a warehouse and visa versa. There are special conditions; a large rise and fall in the tide; a considerable difference in the distances from the dock at which the vessels are moored; and a large variation in the size and weight of the packages. The engineer requests the bidders to submit detail plans and specifications, in order to better enable him to compare the bids and decide on their merits. The contractors realize the justice of the request, submit their plans and send representatives to fully explain them. The problem has been a difficult one—differing in its conditions from anything ever constructed in that line—and the solution has entailed considerable expense. The engineer, after inquiring into the minutest details, awards the contract to a bidder whose name in the trade is synonymous with poor work and low prices. One of the unsuccessful bidders upon hearing of the award and suspecting foul play, telegraphs for the return of the plans and models submitted. He receives in reply a letter stating that the plans had been sent back, but the plans never reached him. Upon further investigation he is informed that his plans have been seen in the possession of his successful competitor, and when the plan is completed it is found to be a counterpart of the plans he submitted.

Were such examples rare, they would not merit recognition or demand action by the engineering societies for their suppression, but the experience of every prominent engineering concern is replete with examples of

*A paper read before the Engineers' Club of Philadelphia by Mr. Chas. Piez.

professional piracy, differing from the above case only in degree.

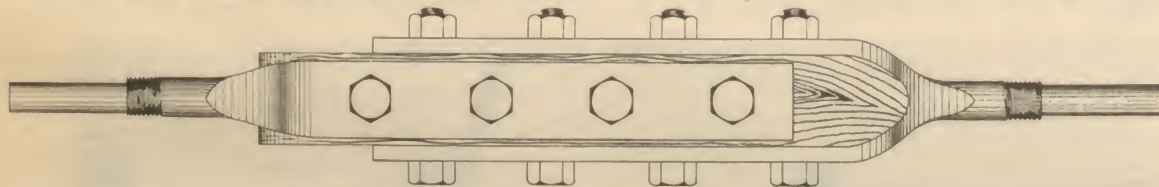
Yet the engineer is placed at a considerable disadvantage as compared with other professional men, is being called upon to submit solutions of problems in competition with other engineers and in being retained or awarded a contract only after he has demonstrated to his prospective client the superiority of his plan over that of his competitors. Protection through letters-patent being impracticable, the engineer is largely dependent upon the good faith of his prospective client, and the latter is no more justified in adopting without compensation either the whole or a part of the plan submitted than a merchant would be in retaining, without payment, goods ordered on trial.

The notion that unprotected ideas are common property is wholly wrong and thoroughly unjust, for it denies the product of mind labor all the rights vouchsafed the products of hand labor. While we cannot hope to eradicate this evil without legislation so long as men are dominated by self interest we should endeavor to inculcate in members of our profession a proper respect for the sacredness of the ideas of others. A high standard of ethics is absolutely necessary to the just discharge of an engineers duties, and it is therefore properly within the province of engineering societies to establish a code of ethics for the government of members and to enforce a strict adherence to it.

Mr. Piez considered that such action, to be effective, must be taken concurrently by the leading societies, and that it would be fitting for this club to take the initiative and present this subject to sister societies for consideration. If the various societies would adopt severe measures for the punishment of guilty members, dishonest practices would certainly be stopped and the standard of professional honesty would be kept high.

INSULATED JOINT FOR INTERLOCKING PIPES.

It is frequently necessary at interlocking plants to insulate switches in using rail circuits and a good insulation in a pipe line whereby the current of the rail circuit could be prevented from short circuiting through the leadout would often save many track insulations. The employment of such a device in the pipe line would enable insulation to be provided between the switch and lock movements or facing point locks and pipe lines in place of insulating the movements from the rails. The accompanying illustration shows a form of insulation which has been designed by Mr. W. H. Elliott, signal engineer of the Chicago, Milwaukee & St. Paul Railway, under the direction of Mr. George Gibbs, mechanical engineer of that road. This arrangement consists of two wrought iron jaws with a plug connection upon each for attaching to the pipe line, and between the jaws, which are set at right angles to each other, a block of 3x3 inch oak is bolted, by bolts passing through the block at right angles to each other as shown in the engraving. These jaws are made of $2\frac{1}{2} \times \frac{1}{2}$ inch iron and the wings



INSULATION FOR INTERLOCKING PIPE CONNECTIONS.

are drilled for three-quarter inch turned bolts, each of which is 5 inches long. The wooden block is carefully fitted to the jaws and it is reported to be giving excellent satisfaction. In putting the joint together, the jaws are placed in position on the block, and the first hole is drilled and the bolt is placed therein and tightened up before the next hole is drilled. In this way, the jaws form templates for the holes and the fitting is accurate.

PAINTS FOR RAILWAYS.

M. F. LINSDAY.

My experience teaches me that if we are to expect a paint to answer its purpose as a preservative of wood or iron, we must have good oil and driers and a pigment that will not undergo a chemical change when brought into contact with air and water. If we place quick lime in contact with air it undergoes a slow chemical change, if with water the change is more rapid and of a somewhat different nature, as lime is not to be considered as a pigment, I merely mention it to illustrate what I mean by a chemical change. If it was possible for us to reduce metallic iron by mechanical means to a degree of fineness that would enable us to mix it with oil and use it as a paint, we would find that the thin film of oil covering the most exposed atoms of the iron pigment would soon give way and allow them to become oxidized by the action of the atmosphere. In doing so the chemical action that would take place, would destroy, yes, actually burn up the carbon in the oil

which was in contact with it, thus allowing air and water to penetrate to other particles of the iron pigment lower down in the coat of paint, this process would go on until all the iron pigment had become oxidized or rusted, and in so doing the elastic and adhesive qualities of the oil that held the pigment would be completely destroyed.

No doubt you have noticed the condition of wood surrounding a rusty nail. Chemists tell us that the wood is actually burned, the oil would be consumed in the same way, so you see we must look for something to use for a pigment that will not undergo a chemical change when exposed.

There are many things used as pigments which meet the requirements in this respect. Among the most useful to railways, I will mention the red and brown oxides of iron, and the better grades of yellow ochre. Plumbago and lamp black, red oxide of lead could be included in this list if it were not for the fact that the red lead of commerce is not a complete oxide. The reason of this is familiar to those acquainted with the process of manufacture. The fact of its not being a complete oxide causes it to be somewhat granulated. I have frequently used red lead that was so imperfectly oxidized that by placing a small quantity of it on white paper and then rubbing it, the presence of metallic lead could be detected by the black marks left on the paper, after the red oxide had been dusted off. This alone is rather a crude test but if you will take the pains to wash the red lead in pan as placer miners wash sand for gold, then dry the coarse particles saved and rub them on white paper there will be no trouble in proving that nearly all red lead contains small granules of metal. This test will not show the metal in all cases, it will do so only when the oxidization is very imperfect.

In some specimens of red lead, these small granules are partially oxidized and are in a somewhat similar condition that partially slacked lime is. In this condition they will not show the presence of metal when rubbed on the paper. Other and less simple tests will be necessary when these partially decomposed granules of lead are exposed to the alternate action of air and water, they are soon converted into a lead hydrate and that in turn is converted into a carbonate of lead by the action of the carbonic acid gas present in the air. The granules of purer metal undergo the same change but require more time. When we see that the color of red lead has faded we may rest assured that this chemical change has taken place; in fact where the color of paint has become lighter or darker on being exposed it is an evidence that the pigment has undergone a chemical change, providing however that the color cannot be restored by the application of a coat of oil.

In decomposing, the small granules of metallic

lead become greatly increased in bulk, the result is that the oil which has become dry and hard is broken up, allowing air and water to penetrate; I will say however that this action is slow but nevertheless exists and does shorten the life of the paint. There is another feature of red lead that we must not lose sight of, and that is, its well known drying qualities, which renders it especially objectionable in dry hot climates. Paint lasts longer in cool, damp climates than it does in dry, hot ones. Dry, hot air causes the oil to become hard and brittle only too soon without the aid of driers, and when in this condition it loses its elastic and adhesive qualities, then comes a change of seasons with its attendant changes in temperature, producing contraction and expansion, which soon breaks the oil up into a gummy or resinous powder, storms follow and what is left of the oil is washed away and the pigment goes with it. Of course this is a slow process but it is sure. Added driers will hasten it and therefore we must be careful about using red lead in dry, hot climates.

We should not use any more driers in paint for outside work in any climate than is absolutely necessary to keep it from running while it is being applied. Enough drier to accomplish this is generally added to the oil when it is boiled; if the pigment is as fine as it should be and the oil contains the proper amount of drier there will be no trouble experienced on account of the paint running.

Paint containing a coarse granular pigment can hardly be kept from running. This is one difficulty I have always met with in using red lead. This tendency of paint to run is frequently the cause of work

costing nearly twice what it should on account of the care required on the part of the painter spreading it to make it lay properly. There is still another bad feature connected with the use of red lead, and that is, its weight, which together with its coarseness causes it to settle in the pots, requiring much time to be wasted in stirring it; besides it works slow and hard under the brush, making the work expensive.

A man can cover from thirty to forty per cent more surface in a day with oxide of iron paint than with the red lead. I may be brought to task for saying that red lead has drying qualities and then saying that it has a tendency to run, especially after making the statement that added driers will prevent paint from running. In answer I will say that linseed oil is classed by chemists as a hydro-carbon nearly free from those vegetable fats common to most vegetable oils and which prevent their drying. The drying of linseed oil depends on its affinity for oxygen; in absorbing and driving off hydrogen, considerable heat is evolved. If the heat is confined as it sometimes is in a bunch of waste saturated with oil, the heat will accumulate to the kindling point, then we have spontaneous combustion. When linseed oil is boiled the heat is sufficient to destroy the fats it may contain that would retard its drying, at the same time the heat drives off part of the hydrogen contained in the oil.

If litharge, (protoxide of lead,) has been added, its oxygen unites with the oil and takes the place of the hydrogen, expelled, the oil is somewhat thickened and dries more readily than the raw oil. When fluid driers, that are rich in oxygen are added to boiled oil at ordinary temperatures, they have a tendency to coagulate it, that is, the oxygen of the drier unites with the oil and expels part of the hydrogen the oil contained and leaves it separated from the oil. When japan dryer is added to linseed oil and lamp black this is especially noticeable. The paint may have been quite thin, but it thickens soon after the drier is added. When paint is in this condition it will not run when spread; after it is spread the hydrogen has a chance to evaporate and does so, much sooner on account of its being already separated from the oil, thus allowing the paint to harden sooner than it otherwise would.

The oxygen of the red lead is not in as available form as the oxygen of liquid driers and will not unite with the oil until the hydrogen of the oil has a chance to evaporate from the surface of the paint after it is spread. This is why red lead will not prevent the oil from running; only part of the oxygen of the red lead is finally appropriated by the oil and none of it would be if the lead had the same affinity for oxygen that iron has. This is one reason why oxide of iron and oil makes a better paint for outside use than red lead and oil.

The next quality that should be considered in a pigment is fineness. The working and covering qualities and durability of paint depend to a great extent on this, the finer the pigment the more thoroughly will it become incorporated with the oil and the more intimate the mixture, the more readily and uniformly will it spread under the brush, thus giving a more perfect coat. Of all the pigments that I have mentioned, lamp black comes first in fineness; plumbago if a good quality and properly prepared, second; oxide of iron and the better grades of yellow ochre, third; and red lead last of all. I can easily see and understand why it is that the impression has gotten abroad that red lead and oil makes a superior paint for iron bridges. It is because it is furnished to the painters in its dry state, and they mix it with good oil. I am ready to admit that this inferior pigment when mixed with good oil makes a paint of equal and possibly greater durability than the superior pigment, oxide of iron may, mixed with a poor grade of oil along with a considerable amount of benzine or naphtha.

The trouble lies in the fact that the oxide of iron paints are bought by the barrel already mixed. In preparing it, the manufacturers use a poor grade of oil, then add from one-fourth to one-third, benzine or naphtha. I believe if railroad companies would specify in their contracts for paint to be used on outside work, that the pigment must be mixed with boiled linseed oil only, and then see that they get what they pay for, we would cease to hear of the many claims now made for the superiority of red lead as a pigment. It is true that if the paint is mixed with pure oil, it would cost a trifle more, but the extra cost per gallon would be more than made up by its covering a greater surface, besides it would be more durable. When the iron oxide mixtures that are in general use, and especially those that are prepared to sell at a big profit are applied and give way, they say, "red lead is the only paint," but they do not take into consideration the fact that, they bought it dry and mixed it with good oil. I do not wish to be understood as saying that a dry

pigment is best, for the best of pigments are improved by grinding in oil, providing the oil is of a good quality. I am aware that many engineers specify that lamp black shall be used in connection with the red lead and oil for painting iron bridges. I will say when this is done that the lamp black and oil are the redeeming qualities of the paint.

A coarse pigment allows the oil to separate from it more readily than a fine one does, causing it to run on iron and allowing it to soak in on wood. It is quite necessary to have part of the oil of the first coat absorbed by the wood and if the pigment is fine some of it will be carried with the oil into the larger pores, making a complete filling and at the same time forming a bond that unites the paint firmly with the wood. The after coat will then make a solid surface for exposure. On the other hand it is bad to have all of the oil of the first coat leave the pigment and be taken up by the wood, and it will be if the pigment is coarse. The oil alone of the first coat will not fill the wood, part of the oil of the second coat will also go in, another part will be taken up by the coarse pigment left on the outside of the wood from the first coat, leaving perhaps half of the oil applied in the second coat to hold the pigment applied with it. The result is that when the second coat is dry, it is porous. This is made worse when the oil has been made thin by adding benzine or naphtha to it. Thin oil will enter the wood more readily than thick oil. It is poor policy to use coarse pigment even if the oil is heavy and of good quality. When the oil is thin and poor they will not do at all. When iron is painted with paint containing volatile oils, such as benzine or naphtha, they separate and leave the paint full of small pores that are always open, and like a sponge they are ever ready to take in air and water. Paint of this kind is not durable, neither does it furnish the protection desired. I have mentioned plumbago as being a pigment of exceeding fineness: if of good quality and properly prepared, when mixed with linseed oil, it makes a paint superior to all others for use on shingle roofs. It is cheap and durable, but can hardly be recommended for general purposes.

I see different opinions expressed as to what is the best paint that can be used to protect the metal underframes of cars and engine tenders, but I have not seen lamp black and linseed oil mentioned. I can say that it will give the best satisfaction of anything that can be used. If it becomes necessary to hurry the work, a small amount of japan drier will do it without materially affecting the durability of the paint. Have the paint rather thicker than you would want other paint.

Lamp black is so exceedingly fine that it will spread out under the brush. Perhaps you have noticed old signs where the white paint has given way and left the black letters apparently as good as ever.

Some years ago the Santa Fe Company painted the hoops on its water tanks with lamp black and linseed oil. When the paint on the body of the tank had given way, those black hoops would stand out in bold relief defying both weather and alkali water. Try lamp black and linseed oil on the iron or steel underframes of your cars and engine tenders, but see that they are thoroughly cleaned of all rust, scale and grease, first. Tar and asphalt mixtures have their uses but they should not be used indiscriminately by persons who do not understand their chemical constituents. I cannot say much about the so-called fire-proof paints, so frequently sold at fancy prices. They are generally known as asbestos paints, and may contain some asbestos, but that does not matter, it is the oil that burns and not the pigment: plumbago or oxide of iron would answer the same purpose that asbestos does, neither one will burn in a degree of heat that can be produced in the open air.

I have never been able to find out how a paint could be made fire-proof when it is composed largely of inflammable oils. If I was buying it, I should require that the seller show why it was fire-proof and then prove his assertion. All paints are a protection against fire in this way; if a coal of fire falls on a surface that is covered with a coat of hard dry paint, it will probably be too cool to kindle the wood before it burns through the paint. It requires a higher degree of heat to kindle dry linseed oil into a flame than an ordinary size live coal will furnish in the open air.

If a good grade of yellow ochre is mixed with good oil and a little lamp black is added, it makes one of the very best of paints for general use, providing the color is not objectionable.

In conclusion, I will say that if the common red or brown oxide of iron pigments are properly washed and freed from sand and other coarse foreign matter and are then well ground and thoroughly mixed

with good boiled linseed oil, they make a paint that can be depended on to furnish a more complete protection against the destroying influence of the elements for a longer time than any other paint that is suitable for wood and iron bridges, also for buildings and cars and for general purposes on railways.

THE PAGE CAR IMPROVED.

In order to meet the demand for a side dump car which would be equally suitable for construction work as for the transportation of minerals and other loose material the Page car has recently been improved and to a slight extent remodeled. The design shown in the accompanying engravings was carried out with a view of producing a car which would be equally well adapted to the transportation and rapid unloading of such material as cordwood, ballast, railway ties, earth, rip-rap, sand and building stone, cinders, pig iron, iron ore or furnace slag. The gondola type was selected as the basis of a dumping car because of the frequent

by and rock on flat iron straps on the upper face of the center sill. A malleable iron extension of the axis enters a cast socket which is secured to the end and cross-sills to hold the boxes in position over the sill. To avoid heavy framing in the ends of the boxes they are not built with a view to sustaining the pressure of the load unaided. They are reinforced by the trestles, which are provided with anti-friction rollers, which meet bearing points on the boxes. The sides of the boxes are closed by doors which hook onto lugs on the box ends near their upper edges, and are secured at the bottom by straps entering keepers on the side sills of the boxes. Their action is automatic. As the boxes tip projections on the doors first drop into seats on the trestle caps to prevent further downward movement. They are then released from the box and hang swinging.

Latches pivoted to the trestles engage lugs at the four upper corners of the boxes at the points which are the farthest possible from the pivotal point. Sheet steel shields hinged to the outer ends of the trestle caps cover the latches and the trestles. They



THE PAGE SIDE DUMP CAR.—FIG. 1.—READY FOR LOADING.

necessity of unloading in other ways than by dumping. For instance, it is often necessary to shovel off a load, and this cannot be done as easily with a hopper bottom car. In this design the center sills give the necessary strength and permit of dumping the load upon either side of the car. It was the aim of the designer to conform as closely as possible to recognized standards in the construction of the trucks and the car body. The trucks may be of any design commonly employed on low flat or furniture cars.

The car body consists of five longitudinal sills with the end sills and intermediate cross sills, the

prevent material from falling between the boxes and dropping on the ends of the latches. They also prevent raising and releasing the boxes. Their hinges are also provided with safety hooks, which engage the boxes and this provides an additional lock. The box is thus secured with four latches, any one of which is sufficient to prevent its turning. Buttons are placed on the interior trestles, where the ends of the shields meet, and these may be turned so as to prevent the raising of the shields. A spring on the button shaft maintains a pressure so as to prevent the button from being turned by anything but a special wrench. This wrench kept only at the unloading



FIG. 2.—SHOWING POSITION OF BOXES AFTER DUMPING.

whole frame being securely bound together and made rigid by seven cross-tie rods and distance blocks placed at the proper intervals, and it is further strengthened by four longitudinal truss rods. The end sills and the two cross-sills are surmounted by trestles very securely joined to the car body by the rods, and they are braced by diagonal rods. The tipping boxes, which are of equal size, are pivoted over the center sill of the car on a steel T-bar axis, which is bolted to the under side and extends the entire length of each box. The boxes are supported

point insures the boxes against being dumped anywhere else, since none of the boxes can be dumped unless the shields are raised.

On construction work where many men are employed the boxes are turned by a direct lift and sometimes by means of cant hook levers. When care is taken in trimming the load in loading it is only necessary to raise the latches, whereupon the boxes dump automatically. Under favorable conditions one crew of men has unloaded and restored the boxes of a car for loading in one minute. Where a large num-

ber of men are not at hand a dumping device may be employed by which two men standing on top of the trestle, one at each end of the box, can tip the boxes, whichever side of the car is desired. The dumping device consists of a malleable iron casting so constructed as to admit of attaching to the box end at its highest point. The casting projects over a rack on the trestle, and is provided with pawls which drop into the detent of the rack. An opening in the casting admits of the insertion of a lever, which is used in moving the casting over the rack. The rack is used as the fulcrum of the lever, the pawls dropping into the detents of the rack hold whatever is gained by each lift of the lever. With one of these devices at each end of the box it may be tilted to any angle desired and kept from tipping back.

The door opening of these boxes is large enough to allow a three foot cube to pass out. When occasion demands the doors can be removed and the car used as a flat car. The floors being horizontal the car is available for a great variety of freight service, whether it is desired to dump the load or not.

The ten cars which the Chicago, Lake Shore & Eastern Railway has in service are 36 ft. long, with

The fire-box is long and sloping and is fitted with a brick arch supported by studs. The valves are of the American balance type with Allen ports. The crank pins are of steel, toughened by the Coffin process. Among the features which assist in giving the open and clean appearance to the engine are the location of the sand box, under the boilers; the check valves are upon the wagon top and are concealed from view. The pilot is of iron and steel and of a light pattern. The cylinder casings are of steel and are painted except the heads which are polished. The running boards are of steel and neat hand railing is provided the appearance of which is shown in the engraving. The cylinder lubrication is obtained by copper pipes under the jacket and oil cups upon the steam chests. The old style No. 9 Nathan lubricator is used. The cross-heads are very light and the piston rods are secured by means of keys.

The Westinghouse automatic brake is provided for driving and tender wheels. The engine has the Gollmar bell ringer, Ashton pop valves, the Player latch or reverse lever and the Smith exhaust pipe. The smoke arch front and door are pressed steel. The driving boxes are of cast steel and are fitted

LARGE AND SMALL CARS.

To the Editor of the Railway Review.

The problem of providing for the efficient use of cars of large and small dimensions does not appear to the writer to present any serious difficulty. It may be divided into two inquiries and stated thus:

1. How shall the full use of small cars be insured when large cars comprise part of the equipment of carriers?

2. How can the economies in cost of service made possible by the use of large cars be fully realized?

The answer to the first inquiry is simply: Provide for such minimum weights on all freight given a car load rating as can be loaded in small cars. This will equalize the charges per 100 lbs. on all car load freight, regardless of the size of car in which freight is carried, and take away the advantage of and therefore the demand for large cars, leaving car distributing officials free to send cars where they can be used to the best advantage by the carriers.

The answer to the second question (the way to realize the economies possible by use of large cars) is: Let the car distributors become thoroughly familiar with



EIGHT-WHEEL PASSENGER LOCOMOTIVE—ILLINOIS CENTRAL RAILROAD.

a capacity 60,000 lbs. each. The height of the floor is 56 in., the height of the side is 8 ft. 2 in. above the rail. The floor is covered with $\frac{3}{8}$ in. sheet steel. The cars are fitted with air brakes and automatic couplers and they were built by the United States Car Co., at Hegewisch, Ill., under patents of C. D. Page, 543 Fifty-fifth street, Chicago.

They may be seen any day in the north end of the yards of the Illinois Steel Co., South Chicago works when they are loaded with furnace slag by a Marion steam shovel with $2\frac{1}{2}$ yard dipper, this material being used upon the construction of the railroad company's new line.

EIGHT WHEEL PASSENGER LOCOMOTIVES
ILLINOIS CENTRAL RAILROAD.

The accompanying illustration was prepared from a photograph of one of a lot of new eight wheel passenger locomotives which have recently been built by the Brooks Locomotive Works for the Illinois Central Railroad. These are to be used in fast passenger service and the first one to be put into service is running between Chicago and Centralia, a distance of 247 miles, this run being made by changing the crews, and from the reports which have been received the time made with heavy trains is highly satisfactory, speaking well for the design and also for the work of the builders. They were built from designs by Mr. Wm. Renshaw, superintendent of machinery. The strikingly neat appearance of the engines is worthy of remark and the result of the care taken in this regard is exceedingly pleasing. The boiler is of the Belpaire type and of the Player patent. There is a single dome placed on the taper connection sheet in front of the fire-box, and beside this and the bell there is nothing upon the top of the boiler outside of the cab. The pop valves and whistle are upon the top of the cab and are connected to the boiler inside of the cab. This leaves the boiler free from obstructions immediately in front of the cab. The air pump instead of being secured to brackets on the side of the fire-box is carried under the front end of the boiler between the guides.

with Cicero bronze bearings. The principal dimensions are given in the following table:

Cylinders	-	-	-	18x26 in
Driving wheels, cast steel, diam. of	-	-	-	75 in
Boiler, diam. of	-	-	-	62 in
Fire-box, length and width	-	-	-	107 $\frac{1}{2}$ x36 $\frac{3}{4}$ in
Tubes, 2 in., number of	-	-	-	274
Tubes, length of	-	-	-	11 ft 7 in
Wheel base, rigid	-	-	-	8 ft. 9 in
Wheel base, driving	-	-	-	8 ft. 9 in
Wheel base, total of engine	-	-	-	23 ft. 7 in
Wheel base, total, engine and tender	-	-	-	50 ft 6 in
Weight on drivers	-	-	-	80,000 lbs
Weight on trucks	-	-	-	40,000 lbs
Weight, total	-	-	-	120,000 lbs
Weight of tender	-	-	-	88,000 lbs
Heating surface, tubes	-	-	-	1649.4 sq ft
Heating surface, fire-box	-	-	-	152.2 sq ft
Heating surface, total	-	-	-	1801.6 sq ft
Grate area	-	-	-	27 sq ft
Boiler pressure	-	-	-	200 lbs
Dry pipe diam.	-	-	-	8 in
Smoke-box	-	-	-	extension front
Smoke stack, diam. of	-	-	-	18 in
Grates	-	-	-	finger bar
Truck	-	-	-	rigid center
Truck wheels	-	-	-	Paige steel tired spoke
Truck Axles	-	-	-	hammered iron
Truck axle journals	-	-	-	5 $\frac{1}{2}$ x12 in
Truck springs	-	-	-	A. French & Co
Pistons	-	-	-	cast steel
Piston rods	-	-	-	Ewald iron, diam. 3 $\frac{1}{2}$ in
Guides	-	-	-	two bar
Crossheads	-	-	-	cast steel, alligator pattern
Valves	-	-	-	American balance
Driving wheel tires	-	-	-	Krupp steel
Driving axles,	-	-	-	hammered iron, journals 8 $\frac{1}{2}$ x11 in
Crank pins	-	-	-	Coffin toughened steel
Injectors	-	-	-	two, No. 9 Monitor and No. 8 Ohio
Cab	-	-	-	oak
Boiler lagging	-	-	-	Magnesia Sectional
Safety valves	-	-	-	two 3 in. Ashton
Exhaust pipe	-	-	-	Smith patent
TENDER.				
Capacity of tank	-	-	-	4,200 gals
Tender frame, I. C. Rd. standard	-	-	-	oak
Wheels	-	-	-	38 in. Paige plate with steel tires
Axles	-	-	-	hammered iron
Journals	-	-	-	M. C. B. standard 4 $\frac{1}{2}$ x8 in

the loading capacity of different kinds of freight, and in filling orders furnish those cars best adapted to economically carry the loads offered.

For instance, there is before me the equipment list of one of our largest western roads. This road has cars 33 ft. long, weighing 24,500 lbs. (12.25 tons) containing 1,648 cu. ft. of box space, and others 38 ft. long, weighing 27,000 lbs. (13.5 tons), containing 2,858 cu. ft. of box space, the axle capacity of each series being 60,000 lbs. If there are at the same time orders for cars to move 16,000 tons of iron and 1 million bushels of oats also weighing 16,000 tons, the well informed car distributor will send his large cars to move the oats and the cars of smaller box capacity to load the iron, the question of cubic box space being a factor of economy in the case of grain shipments, but not in the movement of iron.

One million bushels of oats require 1,250,000 cu. ft. of box space and would require 758 cars of 1,648 cu. ft. box capacity, but only 534 cars of 2,858 capacity, the latter cars weighing 13.5 tons each and the former 12.5 tons; a saving in weight hauled of 2,266 tons or 23.9 per cent, would result from the use of the large cars; estimating movement expenses at 60 per cent of the total cost of carriage, the 22 $\frac{1}{2}$ per cent weight saved by hauling the grain in large cars would be equivalent to 14 per cent addition to net earnings on the traffic over what would accrue by the use of small cars.

The power of car distributors to affect the net earnings of their companies is, in the writer's opinion, but faintly realized.

Agents should also be well informed as to loading capacity of all freight shipped from their stations and held accountable for underloading.

The Car Equipment Guide should be furnished and requested to print the cubic capacity of car boxes of each of the roads so that an efficient use of foreign cars could be obtained. To sum up what has been said. Let minimum weights be fixed at the capacity of small cars. Let car distributors and agents acquaint themselves thoroughly with capacity of different sized cars for loading all car load freight of-

ferred and let the equipment guide print the cubic capacity of car boxes. J. T. RIPLEY.

RAIL TOP CULVERTS.

Culverts with rail tops have certain important advantages over ordinary arch culverts or short span bridges, particularly where the embankments are low, and this applies generally upon western prairie roads where there is not sufficient headroom for arch culverts. An excellent design of rail-top culvert which has proved itself to be entirely satisfactory in service is shown by the accompanying engravings, which were prepared from the working drawings which have been received from Mr. Onward Bates, engineer and superintendent of bridges and buildings of the Chicago, Milwaukee & St. Paul Railway. This culvert is known as the standard of 1896 of the C. M. & St. P. Ry. It is the result of five years' experience, and is a development from earlier forms which have been considered in making this design, the method of establishing standards in the bridge and building department of that road being to build from a design and improve upon it and develop the standard from practical experience covering a number of years. The drawings illustrated will be seen

brick, the spaces between the rails being filled with brick, as indicated in the drawing. The rails are filled in between the heads and over the top with mortar and are covered with concrete. The parapets are let into the space between the two outer rails, which secures them from moving outwardly away from the tracks. The top step course is doweled and serves as an additional brace for the parapet. The steps and top course are usually built of block rubble and the remainder of the masonry is of common rubble except when ordered of concrete. The drawings are sufficiently clear to require little explanation, the width being shown for single as well as double track, the difference in width being 13 ft.

This class of culverts is not uncommon on western roads, but the design upon the Chicago, Milwaukee & St. Paul Railway is so arranged as to permit of using exactly the same style of culvert under many different conditions, and these drawings are so made as to permit of filing the data in connection with the plan of any one of them by merely filling in the dimensions upon the blueprint in the places where spaces are left in the drawings for this purpose. This road has been building these structures for five years and has found them to be satisfactory in every respect, including

The following extract from a letter written by a large user of steel castings in this city needs no comment:

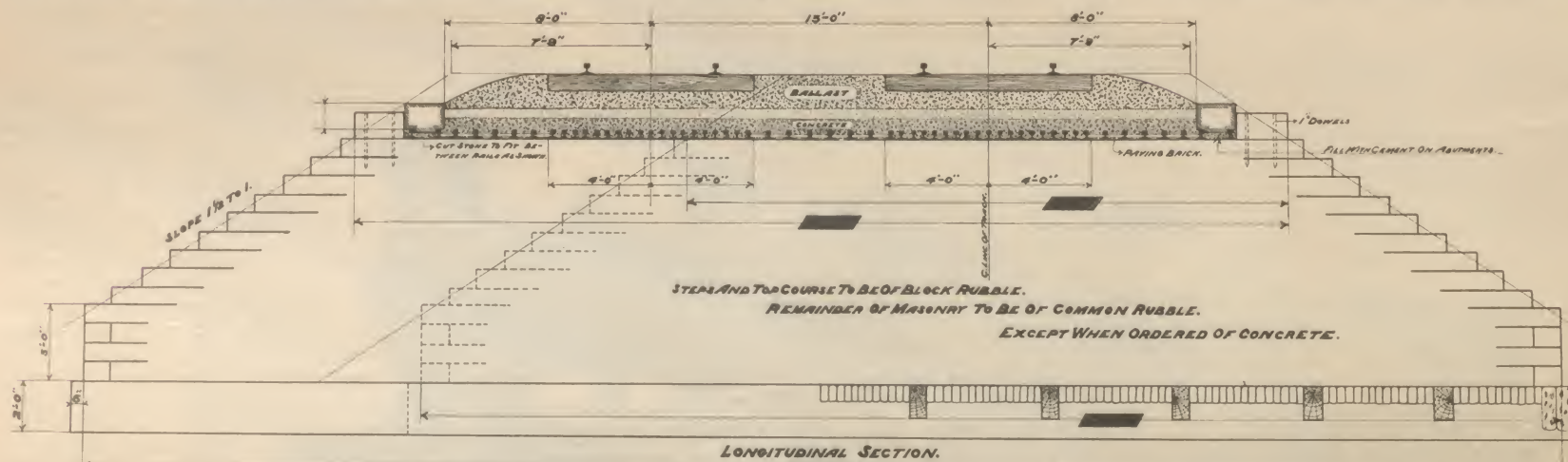
The SARGENT CO., 675 Old Colony Bld., Chicago.

GENTLEMEN:—During the last few weeks we have received from you three lots of steel gear blanks, clamps, etc., a large percentage of which had to be machined all over and were subject to a very severe strain. These were used in the construction of our large machines and were the very best steel castings we have ever come in contact with. Not a solitary blow hole or flaw of any description appeared, and our lathe hands called my attention especially to the softness of the material. We shall forward you an order for more in a very few days.

JUDGE SAGE'S DECISION AND THE CINCINNATI FREIGHT BUREAU'S CASE.

[Communicated.]

Hon. George R. Sage of the United States district court, on October 9, dismissed the petition of the Interstate Commerce Commission which asked for enforcement of the commission's order modifying rates from Cincinnati to the south. This decision defers, if it does not defeat the hope of Cincinnati



STANDARD RAIL TOP CULVERT—C. M. & ST. P. RY.—FIG. 1—LONGITUDINAL SECTION.

to be arranged for different widths of bank and different heights of fill. The drawings show the least depth of foundation to be used except where the masonry rests directly upon natural rock and the depth of the masonry may be increased at the discretion of the engineer in charge.

This rail-top culvert gives a maximum headroom which is permissible under a shallow bank. The height shown in this drawing from the top of the culvert to the base of the track rail is given as 2 ft. 6 in., but in exceptional cases where it is necessary to obtain every inch of waterway possible, this distance

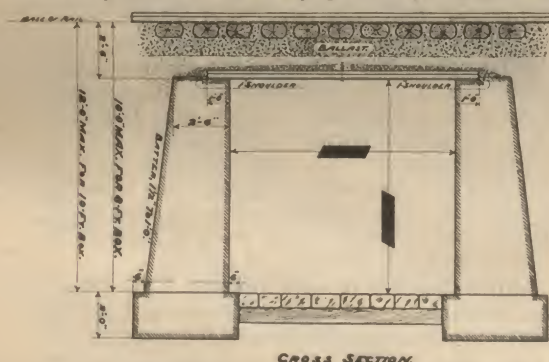


FIG. 2.—SECTION PARALLEL TO TRACK.

has been reduced to 2 ft. This culvert has the advantage over a short span bridge in that, without respect to the length of span, a bridge has two approaches, which are difficult to keep in service, whereas the track over a rail-top culvert is the same as anywhere else on the embankment. The culvert is economical in construction because the walls do not have to sustain a thrust as in the skew backs for arches, and being strutted at the top by the rail covering and at the bottom by wooden struts, they need be of sufficient strength only to prevent their being sheared off somewhere under the rail top. The sectional view in Fig. 2 shows the rail top rails shouldered into the top faces of the walls to a depth of one inch.

It will be noticed that the rails forming the top are placed close together with their flanges touching each other immediately under the tracks and extending to each side of the center of the track to the same width as the ties. Outside of these rails, which are placed close to each other, the floor rails are spaced to a distance equal to the length of a hard burned

brick, the spaces between the rails being filled with brick, as indicated in the drawing. The rails are filled in between the heads and over the top with mortar and are covered with concrete. The parapets are let into the space between the two outer rails, which secures them from moving outwardly away from the tracks. The top step course is doweled and serves as an additional brace for the parapet. The steps and top course are usually built of block rubble and the remainder of the masonry is of common rubble except when ordered of concrete. The drawings are sufficiently clear to require little explanation, the width being shown for single as well as double track, the difference in width being 13 ft. that of cost. Deflection from passing trains is not apparent in such a culvert and the shock of a rolling load seems to be absorbed in the ballast without reaching the rails. This form is employed for banks up to 12 ft. in height, and special plans are made for banks higher than this. Similar culverts have been built with 15 and 16 ft. spans using old iron beams in place of the rails. Where beams are used the spaces between them are filled with concrete and the distances at which they are placed depend upon their size. It is not intended that such culverts shall in all cases be used instead of arch culverts, but the point is that they are suitable where arch culverts are not, and they have the additional advantage over arches in that if the foundation is unstable a rail-top culvert adjusts itself better to any settlement of the walls than is the case with arches.

TESTS OF STEEL CASTINGS.

The Sargent Company of this city has been gradually building up a very fine trade in general steel castings a large portion of which is in railway lines and at present the works are running full of orders. The quality of steel turned out is above criticism both in the smooth and solid appearance and the results given from tests. A large portion of the work is made under specification and the U. S. government specifications are frequently used. The following table gives the requirements of these specifications and also the average result of a large number of tests made from a mixed lot of castings which shows that the results obtained are much better than the requirements:

Physical Properties.	U. S. Gov't Specifications.	Sargent Company Averages.
Tensile strength, pounds per square inch.....	60,000	62,450
Per cent elongation.....	in 2 in., 18	in 8 in., 24.5
Per cent reduction of area...	not specified.	46.3
Per cent phosphorus.....	under 0.06	under 0.04.

The following table gives the individual results shown by tests from several different heats.

Heat No.	Tensile strength per Square Inch.	Per Cent Elongation in 8 in.	Reduction of Area.
E 138.....	67,800	22.5	41.5
E 141.....	60,200	24.8	46.6
E 142.....	64,700	23.3	44.7
E 144.....	59,300	24.8	46.9
E 149.....	60,500	26.2	45.4
E 154.....	62,200	25.5	52.5

merchants for relief against an admittedly defective and unjust system of freight rates, which has been in force and has operated to the detriment of Cincinnati trade for nearly 20 years.

The decision does not review or advert to the merits of Cincinnati's contention. It simply construes the interstate commerce law and denies that it authorizes the "Interstate Commerce Commission to prescribe maximum rates for the transportation of freight." Quoting the language of the supreme court, it says:

"Whether congress intended to confer upon the Interstate Commerce Commission the power to itself fix rates, was mooted in courts below, and is discussed in briefs of counsel. * * * * * We do not find any provision of the act that expressly or by necessary implication confers such power." The right of the commission to make the order which these proceedings sought to have enforced, being thus disposed of simply by a point of law, the court did not find it necessary to touch upon the merits of the case itself. Hence, the railway companies, the commercial societies and communities, as well as the learned counsel who have labored and waited through several years, looking to the United States court for light, find themselves just where they started, so far as the vexed commercial issues involved are concerned.

Of course the Interstate Commerce Commission will pursue an appeal through the United States circuit court of appeals, and of course the supreme court of the United States will be asked to pass in judgment upon the decision, and in the meantime, the railroads will collect, and the community must pay, for transportation upon a basis which has not yet been successfully defended: upon a basis, which, so far as Cincinnati and tributary territory is concerned, should in equity and good conscience be modified.

It is claimed, and correctly so, that generally speaking the rates of compensation collected by the railroads of the country for the movement of freight have, during the past decade undergone great shrinkage, yet the rates upon the higher classes of merchandise from Cincinnati to the interior south are to day practically as they were fixed in convention 20 years ago. This policy should command attention of the advanced thinkers, who have come into the management of the Southern Lines during the past five years and their experience and resources should enable them to find a remedy. In

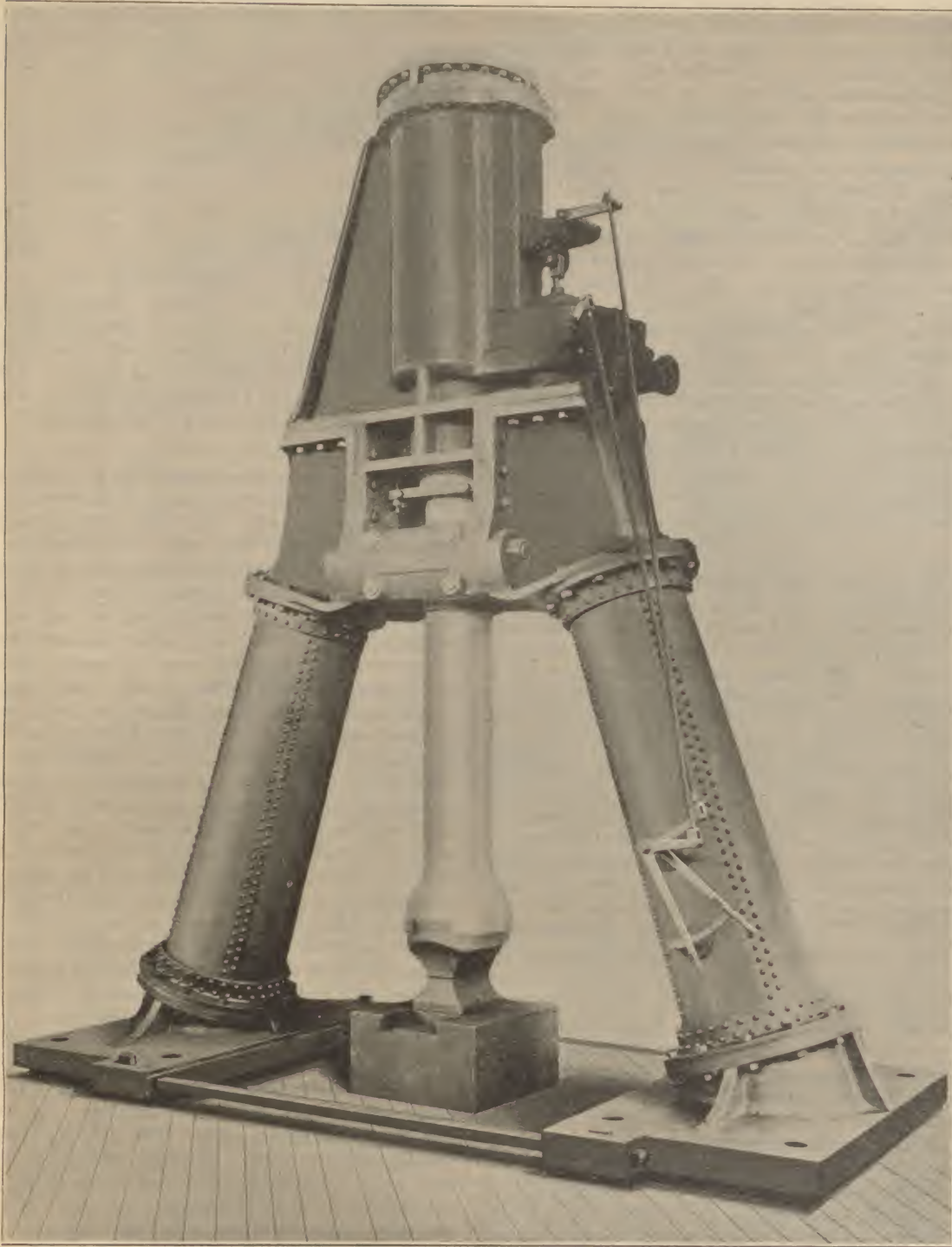


FIG. 22.—OPEN FRAME 12-TON STEAM HAMMER.

the meantime, commercial communities and societies must continue to discuss the question.

If the courts find the law deficient, congress can make it effective, but after all the managers should recognize the danger to corporate interests which attends legislation, and should establish with the people whom they serve, such equitable relations and cordial understanding as will minimize the public sentiment, which supports adverse legislation.

The longest bridge in the world is the Lion bridge near Sangang, China. It extends five and a half miles over a part of the Yellow Sea and is supported by 300 huge stone arches. The roadway is seventy feet above the water and is inclosed in an iron network.

MODERN IRON WORKING APPLIANCES.

V.

POWER HAMMERS.

In heavy steam hammers there is a great variety of design, and as these tools are usually used in some special work, the designs are generally adapted to some particular requirement. In heavy hammers there is considerably greater latitude for variation in design than in light ones, and the result has been that it is not often that two machines are built from the same drawings. One of these special hammers is shown in the accompanying illustration, Fig. 22. This one was built by Bement, Miles & Co., of Philadelphia, for the Facer Solid Steel Car Wheel Co., Limited, for use in forging steel wheels from solid material. The design of this hammer is decidedly

novel, and it is altogether different from anything heretofore introduced, the columns or standards which support the cylinders being constructed of steel plates which are rolled into the required form and riveted. These columns are secured to the upper and lower members by means of rolled steel flanges, which engage with corresponding flanges in the castings upon which the cylinder is mounted.

The weight of the falling parts is 12 tons, the diameter of the cylinder 30 in., the stroke 6 ft. 6 in. The piston rod is of steel and 21 in. in diameter. The hammer is double acting, taking steam above and below the piston. The valve gear is operated by hand, the valve being perfectly balanced. The piston rod has two guides, both of which are provided with adjustments for taking up wear and for keeping it in line with the cylinder. One of these guides is embodied in the bottom of the cylinder casting, and the second one between the frame castings just above the top of the standards. The base plates are held in place by two heavy bars, one end of each of which is

passed through one of the base plates and keyed into position. This hammer has been designed with a view of facilitating the removal of all of the working parts for examination or repair, and also of accomplishing the best results at the minimum cost. It is provided with a steam cushion at the top of the cylinder, and is an excellent example of one of the latest designs of heavy machines which has been produced.

One of the best known tools for light blacksmith work is the Bradley cushioned hammer which is admirably adapted for a large proportion of the work required in freight car building. The original form consisted of a heavy wooden helve carrying the hammer head and pivoted at the rear end. It was driven by an eccentric by means of a belted pulley. This design has been improved and the most recent form is shown in Fig. 23. In its construction a helve of steel is used in an arched form, with the head or ram carrying the die sustained and operated by a substantial endless leather strap, suspended between spool-shaped bearings, and extending lengthwise of the helve. This device allows of the utmost possible opening between the dies, either at rest or in action, and its elasticity and freedom of motion increases the throw of the ram. The head travels between adjustable guides which give it the perfectly square and accurate movement which is desirable for die work.

The hammer is operated by an eccentric at the rear, connected by a pitman to the saddle or oscillator which carries the helve, and by this helve, motion is imparted to the head or ram. By the use of a steel helve and the strap in connection with it, the force or weight of the blow of the ram is multiplied many times, but with a degree of elasticity that reduces danger of breakage, and at the same time thoroughly cushions the jar to the working parts of the hammer when the blow is struck.

Every working part of the entire hammer is in full view of the operator, and the whole is simple in construction and manner of adjustment. A split friction sleeve on the pitman at the rear of the hammer allows the length of stroke to be instantly adjusted—a matter of great value when material greatly differing in size has to be successively worked. The tension of the strap carrying the ram can be adjusted quickly and in a very simple manner, while the force and rapidity of the blow is under complete control of the operator by means of the foot treadle acting on the belt-tightener pulley. The greater the pressure of the foot, the heavier the blow.

By the use of a friction sleeve on the pitman the opening or distance between dies when at rest can be varied from actual contact to 6 or 7 in. in the smallest size of hammer, and from 12 to 15 in. in the larger sizes. These variations can be brought about instantly, making the hammer especially valuable in jobbing shops where material differing greatly in size has to be worked. In making these various changes no other of the working parts of the hammer have to be adjusted, as the one operation of changing the length of stroke adjusts every working part at the same time. These hammers are made in ten different sizes the weights of the hammer heads ranging from 15 lbs. in the smallest to 500 lbs. in the largest.

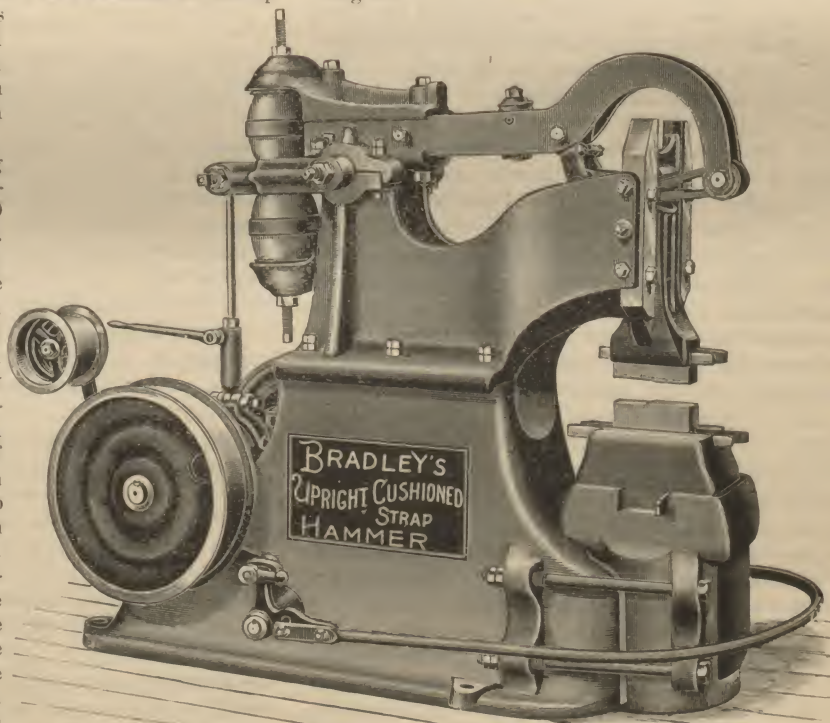


FIG. 23.—UPRIGHT CUSHIONED STRAP HAMMER.

THE RAILWAY REVIEW

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CHICAGO, SATURDAY, DEC. 5, 1896.

THIS is not a good time for trusts in the iron business. The wire nail people, plate and structural material makers and one or two other branches have felt the crippling influence of the times. The billet manufacturers have proclaimed themselves masters, but buyers are inclined to wait and see. The steel rail manufacturers are not willing to put prices where they ought to be until the pressure is greater. The coke manufacturers are conferring together to see if they cannot keep prices up in the region of monopoly quotations. All these efforts are due in a measure to the anticipation that times would very greatly improve during the winter. While the skies are brightening, there is no evidence as yet of such an expansion of demand as will enable manufacturers of ore, coke, iron and steel to exact such prices as will afford fat margins. The steel rail makers meet and talk but do not speak the word that 1897 railroad builders are waiting to hear them speak. Much railroad work would be done if rails were twenty-four instead of twenty-eight dollars. The railmakers are presumed to know long-sighted from short-sighted policy. There is a feeling in several branches of the iron trade that prices ought to be lower and that manufacturers might have less to complain of if narrower margins were acceptable. For the present there will be no rush after material.

A PRACTICE which has much to commend it, has been noticed in connection with the Brightwood shops of the Big Four Railway, wherein the room for placing engines upon pits for repairing is limited. Where locomotive building is done on an interchangeable basis, the plan would seem to work very well in many cases. In the case referred to, there are a number of engines of a certain class which are built so nearly alike as to permit of carrying an extra boiler in stock which will fit any one of them. The method of operating the scheme is to keep the spare boiler in the shop for repairs, and when one of the engines of this class comes in, the spare boiler is ready to go out upon it, and the boiler which comes in on the engine, becomes the spare boiler and is repaired at once to be ready for the next engine of the series. In this way a shop with room for only seven locomotives on pits at once, is capable of turning out more than that number of locomotives per month with general repairs, and such a record in a district having bad feed-water would be impossible without preparing in advance in this way for the rushing of the work. In the case referred to the plan works especially well in connection with equipping simple locomotives with compound cylinders. The cylinders are placed upon the extra boiler before the engine to which they are to be applied is brought in, and it becomes a short piece of work to put the engine together and return it to service.

QUITE a stir is being made in England over the idea of establishing a national railway museum, the chief advocate of such an institution being Mr. Clement E. Stretton, who is well known as an authority

on many railroad subjects. There are several reasons why a railway museum in England might be made a very interesting and valuable institution on account of the large number of relics of the earlier days of railways in existence which are not now available to the public or to engineers without the use of considerable time in the search for them. The difficulty now seems to be to get sufficient financial support for the museum. It is reported that the London & North Western Railway at one time contemplated establishing a museum on its own account but the lack of a suitable place for the collection has prevented action in the matter, but it seems probable that some scheme will be carried through. Aside from the value of the curiosities, a collection of railway relics would have a great value as precedents for future work. In the absence of an institution of this kind it is a difficult matter to gain access to old drawings and records or the work of former engineers, and a museum might easily be made of great value to students and designers. Its usefulness would be specially enhanced in England because of the lack of such organizations as our Master Car Builders' and Master Mechanics' Associations.

THE subject of inaccuracies which are introduced into cards taken from steam engine indicators has been frequently mentioned in these columns and now an additional cause for variation in these diagrams has come to light which explains many cases which have arisen, in which the length of cards has varied in such a manner as to cause surprise and some annoyance. The influence of curved pipes is referred to, it having been found that these pipes sometimes act after the manner of the hollow spring in the Bourdon pressure gage which, by straightening under the pressure, admits of reading the pressure per square inch on the dial. In many cases any effect which might be introduced by this means upon indicator cards would be balanced upon both ends of the cards, but it is easy to see wherein a slight straightening of pipe which might be imperceptible to the eye would cause an inaccuracy in the length of cards, and if, on account of methods in which the pipes were bent, one side had more flexibility than the other, a movement of the indicator relative to the cylinder would be caused, which would be fully as detrimental as the stretching of the cord or the slack in the connections due to lost motion. This furnishes another reason for taking special precautions to see that indicator rigging is properly applied before taking cards upon which great responsibility is to be placed, and considering the effect of long pipes, that of the stretching of cord and lost motion in connections, it is believed that many cards which have been taken and used as bases of important comparisons, have perhaps been misleading, and those who imagine that the application of an indicator to a steam engine is altogether a simple matter are decidedly mistaken. It has been so considered and so much the worse for the cards.

THE decision of the United States circuit court of appeals reversing that of the lower court in the case of the St. Louis Car Coupler Co. versus the Shickle, Harrison & Howard Co., which was handed down in St. Louis, November 30, is one of considerable importance to both the makers and the users of couplers. The full text of the decision (which will be published later), is not available at present writing, but some extracts which were permitted by the court to be made, indicate in some degree its scope. The court holds that the purchaser of a patent coupling device having once paid the royalty attaching to the patent, should have the right to replace a broken knuckle without the payment of an additional royalty, provided the drawbar is still serviceable. In the opinion of the court the drawbar is the essential part of the patented combination around which the other parts are gathered, and which parts are in the nature of the case much more liable to be broken, and, says the court, "It can hardly be supposed that a railroad company would equip its cars with a patent coupling apparatus like the one in controversy, one part whereof is liable to be broken long before the drawheads are worn out, unless the purchase was made on the implied understanding that the purchaser had the right to replace that part of the ap-

paratus, if it was accidentally broken, without being compelled to pay further tribute to the owner of the patent." But the opinion also asserts that the right to manufacture and sell coupler knuckles must be confined strictly within the above named limits and holds that the manufacturer of such knuckles would be liable as an infringer, if it so happened that the knuckles made by it and sold, should be used by the purchaser in the construction of complete couplers, and continues: "If the defendant continues to manufacture the knuckles and keep them in stock, it must see to it that they are sold for the purpose of repairing the patent coupling device, to persons or corporations who have acquired the right to make and use them for that purpose." We are advised by the plaintiff in the case that it does not accept the decision as final, but proposes, when occasion offers, to again bring the matter up in another district, from whence should a different decision be obtained, the case might be taken to the supreme court.

SEVERAL papers have recently been presented before railway and other technical clubs upon the subject of compressed air, but in the discussions upon them it is noticeable that very little attention has been paid to the subject of re-heating the air before using it in motors or other forms of machinery. While it is known that material benefits may be derived from heating the air immediately before it goes to the motors or is used in other ways, it does not seem to be considered worth while to even experiment in this direction in most shops where air power is extensively employed. Professor Unwin has shown that heat applied in rewarming compressed air is used nearly five times as efficiently as an equal amount of heat employed in generating steam. This looks well for the value of re-heating air, but the value is expressed in terms which are rather indefinite, for reason that comparison with the steam engine conveys but a vague idea of practical efficiency. Mr. Robert Hardie is reported as having figured the cost of reheating by the use of a hot water reheater at one-eighth of the cost of coal required at the compressor, and Prof. Haupt in speaking of this heater, has said that four hundred horse power would be required to compress one thousand cubic feet of free air per minute to two thousand pounds pressure, which would consume twelve hundred pounds of coal per hour, which at three dollars per ton would cost one dollar eighty cents. The cost of reheating the air which is double the work performed would not exceed twenty-two cents and experience with the Rome air motor is quoted to show that these are not only theoretical but practical figures. This motor with a heater ran fourteen miles with a consumption of three hundred eight cubic feet of free air per mile and the consumption per mile without reheating was six hundred sixty-one cubic feet of free air. It is evident from these figures that reheating will pay wherever it can be used. The difficulty in connection with employing reheaters in railway shops is not because of lack of convenient methods of heating, but rather because of the methods of using air which, except in large applications, as a rule, are intermittent and not sufficiently constant to enable the complete benefits of the scheme to be derived. There would seem to be no reason however, why reheaters should not be made to pay wherever the consumption of air is sufficiently regular to keep it in circulation and not allow it to cool too quickly. A heater can easily be made of pipe and steam heating may be employed. This is a subject which is worthy of much more attention than it has received, and it is believed that the conditions round railway shops would permit of using it to good advantage, at least in a majority of cases.

THE CHANGING CHANNELS OF TRADE.

The ever changing distribution of trade throughout the United States caused by the establishment of new transportation routes is a subject which demands the most careful investigation and diligent study. To have prophesied ten years ago that certain channels of trade now controlling large traffic were even possible, would have been to subject one to ridicule, but these channels have been opened by a process of natural selection, and others will continue to be opened until the map of commerce will require

to be wholly redrawn. No better illustration of changing conditions can be conceived than that furnished by the new routes through the southern states. The RAILWAY REVIEW has heretofore been inclined to regard as chimerical any serious attempt to divert from northern sea ports a large amount of general trade. It was believed that in order to establish new channels of commerce of any considerable size, two chief elements were required. First that such routes must be exempt from interruption for any continued period of time from any cause, and second, that climatic conditions must be favorable to the safe handling of the commodities likely to seek such channels. Past experience seemed to have demonstrated that both these objections could be fairly laid against the building up of any heavy export trade through southern ports and for that reason it has been thought that no serious danger menaced the routes via the Atlantic coast ports.

The RAILWAY REVIEW frankly acknowledges that it has been mistaken the development of the past five years, notwithstanding that during most of that time business has been seriously depressed, has proved conclusively that the view heretofore held must be abandoned. It has been demonstrated that the conditions attaching to southern ports are not unalterably or even seriously opposed to the establishment and maintenance of through channels of commerce for practically all classes of commodities. It was long believed that the humidity of the gulf ports would prove an effectual bar to the shipment of bulk grain except for a very brief period of the year. Indeed the earlier experiments in that direction appeared to amount to a complete demonstration of this theory. When, however, New York is obliged to take third place in the amount of corn exported, allowing both Baltimore and New Orleans, to pass her, it would seem to be conclusive that former theories must be abandoned, and that changes are at work which will effect a complete rearrangement of commercial channels. The rapidity with which these changes have come and the magnitude they have already assumed, is not the least astonishing phenomena of this new development. Not longer than five years ago, but one southern port, if we except Baltimore, possessed a direct steamship line to Europe, whereas, at the present time, nine separate ports are so served. It is probably true that some of these ports afford as yet but meager returns for the lines thus established, but the fact that they are continued is abundant evidence that prospects for a remunerative trade are not lacking.

It is wise, therefore, for the managers of the older routes to take account of this new movement. Not in the sense of attempting to throttle it, for that will be found impossible, but rather in an effort to adjust their business to meet the changed conditions. How this may be done is not easy to determine. Certainly it is not to be accomplished by an endeavor to choke off the new routes by a reduction in rates. Increased tonnage induced by reduced revenue is of all railroad policy the poorest; and although a favorite practice with many railroad lines, it would, as applied to the subject under discussion, prove utterly futile. The combined cost of transportation by rail and water, is, from a large portion of the grain producing section of the west, cheaper via southern ports than via eastern, and other circumstances being equal, this element will be found controlling. The policy of railroading during the past few years has been one of reaching out for everything in sight regardless alike of the cost to the individual road, or to interference with the business of other roads. This policy will have to be abandoned and in its place must come limits more or less defined, which shall determine the legitimate field of operation for each road. If, for illustration, grain from Kansas can reach the European market via New Orleans or Galveston, at less cost than via New York or Baltimore, money should not be wasted in the attempt to haul it via the latter ports; and on the other hand, other sections of the country that can be better served via the Atlantic seaboard than via the gulf routes, should be allowed the benefit of such advantage. It is not the diversion but the division of traffic that should be the aim of the carriers, and the allotment among them of the traffic properly tributary to their lines is the true solution of this as well as some other traffic problems.

INTERCHANGEABLE MILEAGE TICKETS.

The question of the issue of a five thousand mile interchangeable mileage ticket has been under consideration by the roads comprising the Central Traffic Association, with the result that permission has been granted for such roads as desire to unite in the issue of such a ticket. The action is thought to be a movement in the right direction. The issue of such a ticket has been advocated in this journal for some years, and it is believed that the subjoined extract from the RAILWAY REVIEW of June 4, 1892, fairly states the case:

It should be understood that in the consideration of this question the arguments for and against the issue of such a ticket depend largely upon whether the question is viewed from the railroad or commercial travelers' standpoint. Outside of the argument arising from the fact that a carrier is bound to furnish all reasonable conveniences to the public in connection with the transportation of persons or property, there is not a great preponderance of evidence in favor of the issue of such tickets from the standpoint of a railroad company. They will not serve to stimulate travel to any great extent, nor will they add to the gross revenues of the companies uniting in the use of such a ticket. On the contrary, the proceeds which now accrue to individual roads from tickets which, by reason of expiration of time limit, loss or other causes, operate to their advantage, each road would then receive compensation only for the actual number of passenger miles carried, and in addition thereto would suffer from such inability to collect for coupons as might be lost between the time of collection from the passenger and redemption. This, however, would form no legitimate argument against the use of such a ticket, for each road should so conduct its business as to care for all receipts taken in connection therewith. The use of such a ticket would also entail some extra work upon the auditing department of a railroad company, although by means of a properly regulated clearing house this extra labor would be so reduced as to be scarcely appreciable. As an offset to these and some minor disadvantages which it is not necessary to enumerate, the main advantage to the railroad companies arises from the fact that such tickets could be surrounded with safeguards which would absolutely prevent their illegitimate use, and thus prevent their manipulation by scalpers. As stated in a previous article, the advantages to the commercial traveler afforded by such a ticket are sufficient to warrant their assent to any legitimate prescription in the way of identification.

One of the strongest objections urged against the adoption of a ticket of this character is the difficulty of properly regulating its sale. One the one hand, it is claimed that weak lines desiring to raise money for a temporary purpose will find it to their advantage to sell large numbers of them at a slightly reduced rate and thereby realize a sum which has to be refunded only as called for in the way of redemption of the tickets as used. Or tickets may be sold by a line while operated under its charter organization, but which by passing into a receiver's hands would fail of redemption when presented. The sufficient answer to this objection is that such tickets should be sold by some central agency, the proceeds being deposited as received and held in trust for redemption purposes. Such action would inure to the benefit of the association, for the interest on unearned balances of such sales could be applied as against the expenses of transacting the association business. No valid objection could be urged against such a course, at least by the roads. They certainly are not entitled to the money until they have earned it, and it is therefore no more a deprivation to them than is now the sale of coupon tickets by connecting lines. Nor could the public complain. The lower rate of carriage and the universal character of the ticket are a sufficient recompense for the advance investment they must make in order to secure the advantages offered by them. If, on the contrary, it should be thought desirable to have the sale of these tickets more widely distributed they could be put into the hands of the individual roads, a fund sufficient to guarantee the prompt payment of coupons when presented, being deposited with the chairman of the association, and the amount due the various roads presenting the coupons paid through the association as a clearing house.

From the side of the commercial traveler there is much to be said, and as a part of the traveling public the commercial traveler is entitled to consideration. We do not subscribe to the idea that this class of travelers is a benefit to the railways in the way of increased traffic, nor endorse the assertion of one of their own number "that commercial travelers are in a sense quasi freight solicitors for every line of transportation over which they travel." So far as this point is concerned, we hold that the commercial traveler operates to reduce rather to increase the revenue of a railway company. Not an added pound of freight is shipped over a railway line because of him, while on the other hand, one man in the person of a commercial trav-

eler by carrying the market to one hundred merchants removes the necessity which would otherwise exist for these same merchants visiting the commercial centers in order to supply themselves with goods. That, however, affords no argument against the issue of the 5,000 mile interchangeable ticket as compared with the present 2,000 mile single road ticket. One is as effective in its influence upon the revenue of the railways in this respect as the other, and that point is, therefore, of no force in the present argument.

The commercial traveler, not by reason of any conferred benefits, but because he is a traveler, is entitled to all the conveniences which may consistently be granted to him, and the advantages in that direction growing out of a 5,000-mile interchangeable ticket in lieu of the present issue may be briefly enumerated as follows, based of course upon the supposition that in both cases the ticket is to be honestly used, a condition it is more than feared does not always obtain in connection with the present 2,000-mile ticket. First, it involves a less expenditure as an original outlay to supply the necessary number of miles of travel. A single 5,000-mile book good over any and all the lines in a certain section of the country is fully equal to 10 mileage books of the individual roads. Second, it affords a degree of convenience not possible with the use of a large number of mileage books and avoids the danger of their being lost or mislaid when wanted for use. Third, it supplies a much easier means of keeping a mileage account of travel and consequent convenience and check in the make-up of expense account. Fourth, being sold at net prices it avoids the trouble incident to the collection of the rebate or extra payment demanded upon the present issue of mileage tickets. Fifth, it permits of a change of route, if for unexpected causes such change may be found to be desirable, so that by use of a short cut, miles of unnecessary travel can be saved, which, in the absence of such a ticket could not be avoided. Sixth, it will answer all the purposes of a weak-end ticket permitting the holders thereof to reach their homes from any point within reasonable distance by the nearest available route. Seventh, it will guarantee to employes that their employes are not speculating on the tickets furnished for the conduct of their business and thereby bringing themselves and those they represent into disrepute.

These are some of the advantages which will accrue to the commercial traveler by the use of such a ticket. It is probable, however, that the principal argument which may be used in support of the issue of a five thousand mile interchangeable ticket is the broader one of mutual concession for the general good which will be engendered by its issue. Most if not all of the antagonism existing between the public and the railways and which finds its expression in the utterances of public speakers, as well as in legislative enactments, is the outgrowth of the idea that the interests of the railways and the public are antagonistic and that an action which will be of benefit to one must of necessity be an injury to the other. That the idea is an absurd one is no less true than it is almost universal and the issue of and use by commercial travelers of such a ticket will have a large influence in counteracting this impression and in establishing the fact that the interests of both classes are mutual.

It is not desired to add anything to the above extract except to emphasize the necessity for the withdrawal of the ordinary mileage ticket now in use. With the authorization of the five thousand mile interchangeable ticket, the apparent need of the smaller ticket is removed, and with its abandonment will go many of the abuses which now attach to it.

One of the primary considerations in the operation of railroads is the providing of all reasonable facilities for the convenience of the traveling public and the adaptation of such facilities to the various classes of traffic. Nor are the American people slow to demand that to which they deem themselves entitled, and to seek its enforcement in case a voluntary compliance is withheld. It is not intimated that the roads could be compelled by law to issue an interchangeable mileage ticket, but should sufficient opposition be engendered because of the refusal to issue such a ticket, requirements much more burdensome could be readily imposed. The movement already on foot looking for a universal two-cent mile rate, throughout the west, was started chiefly because of the refusal of the western roads to issue a five thousand mile interchangeable ticket, and a reconsideration of the matter would go far towards putting a quietus upon it. The commercial travelers possess a force not to be despised and when as in the present case, there are good reasons why their request should be complied with, it is at least doubtful if it is the part of wisdom to antagonize them.

Government and the Railroads.

There is a possibility that the power of the Interstate Commerce Commission to prescribe railway rates may be questioned by the supreme court, in which case the commission may feel obliged to recommend to congress the passage of a measure definitely committing to them that right. The discussion attending such a measure in congress could not fail to be interesting, says the United States Investor. The mere theorist might have good ground for complaint against such action? So long as the government does not own and operate the railroads of the country, it must remain an open question how far its right extends to interfere in their management. That it possesses the right to interfere up to a certain point is implied in many cases in the privileges which it has granted, and in all cases in that section of the Constitution of the United States, which gives to Congress the right to regulate commerce. But where is that point? Probably that question will never be answered to the satisfaction of everybody.

It will have to be admitted that the problem presented by the railroad situation of this country is one of the most difficult with which the human mind has ever had occasion to grapple in its contemplation of material affairs. Railroad officials proceed upon the assumption that in order to make their properties pay it is necessary to make discriminations between their patrons in the matter of rates and accommodation. Such a policy is quickly resented by the public, and with a large showing of justice. The railroads have all obtained valuable privileges from state or national government, and in theory at least are bound to act with strict impartiality in dispensing their services. We say in theory, because it may pertinently be asked if the public good, as a matter of fact, may not better be served by apparent discriminations—that is, unless the complete reorganization of our entire railway system is to be brought about.

For instance, in many parts of the country the railway mileage is too great to permit a fair profit on the present capitalization, if the roads are debarred from pooling in one form or another and from rate discriminations. The conditions are such that our railroads are constantly under the inducement to evade the existing laws against these practices. It is a matter of life and death with them. Would it be wise, from a strictly economic point of view, for the public to press their claims against the railroads to their full extent? Such a course would be most likely to result in widespread disaster on the part of the railroads, and it would then be a question if the benefits accruing to the people at large had not been more than offset by the misery entailed by the collapse of the roads. Obviously, a middle course is the best.

The railroads are in their present position through the recklessness of their projectors and managers, but it does not follow that they should be shoved headlong to destruction because of this fact. Recklessness is a trait of human nature which in one form or another seems to be common to the race, and in all our dealings with our fellows we have to make allowances for that fact. It is sound business policy—to say nothing of its being sound philanthropy—to do all in one's power to modify the evil results which are likely to overtake one's neighbor as the result of his over sanguineness and poor judgment. If everyone were allowed to suffer the full logical result of his faulty methods, business would soon come to a standstill. It is with a recognition of this fact that congress and the people should approach the railroad problem. To make the best of a bad mess should be our aim. The question is, how far will the further interference of the government into the affairs of the railroads accomplish this end?—[National Corporation Reporter.]

STEEL FOR BOILERS AND FIRE-BOXES.*

About fifty replies have been received by the writer to a circular letter sent to the chiefs of the motive power departments of railroads, to locomotive builders and steel makers. So far as possible the experiences given in these letters are brought together in condensed form under appropriate headings in this paper for ready reference by all interested, and it is hoped that further points may be brought up in the discussion.

It is at once seen that several roads have not adopted the high tensile strength specified by the Master Mechanics' Association, while the specifications adopted by the Association of American Steel Manufacturers is in marked contrast to these. Officers of several roads write that they have decided to use only certain makes of steel for fire-boxes and prefer to specify simply the best product of these makers and not attempt to get the benefit of buying in the open market upon rigid specifications of their own. In every case the makers spoken of in these letters are members of the Association of American Steel Manufacturers, and naturally it may be inferred that these makers adhere to the specifications of their association.

The Carnegie Steel Company, Ltd., writes that it has been its experience that a steel of less than 62,000 lbs. tensile strength has been the most satisfactory to its customers, and adds that this statement is based upon the record of its claims department. The Illinois Steel Company recommends an upper limit of 60,000 lbs. for fire-box plates.

The specifications of the Association of American Steel Manufacturers were adopted after a very full discussion of the subject by all of the plate manufacturers of the country, and while a few preferred to have a range of 50,000 to

58,000 lbs., the opinion of the majority favored the 52,000 to 62,000 lbs. range for fire-box steel. This shows that experience has led the steel makers to recommend very soft steel for this use. In the same connection this statement is received from the Union Pacific road:

"Until three years ago we allowed a limit of 65,000 lbs. in the tensile strength. For two and one-half years our experience with steel of from 50,000 to 56,000 lbs. tensile strength leads us to believe that it is better material than that of a higher tensile strength, as it is less liable to crack."

From the New York, Chicago & St. Louis Railroad comes the report that they specified a tensile strength, desired, of 56,000 lbs. for twelve new boilers and fire-boxes built in 1895; and an elongation of 26 per cent and reduction of area of 60 per cent, which they feel insures a good ductile steel.

The statement of one correspondent, that "what is most necessary to guard against in plates and stay-bolts is cheap material which is on the market, and the following of specifications of parties not familiar with actual manufacture," has a great deal of wisdom in it.

Although the Illinois Steel Company is a member of the Association of American Steel Manufacturers, their specifications for fire-box steel are noteworthy in that they place the ultimate strength at from 50,000 to 60,000 lbs. and differ from the association in chemical requirements as indicated.

It is noticeable that the specifications all omit any reference to elastic limit of the steel and experience goes to show that it is quite as well to do so, as the "elastic limit" is such an indefinite point when determined in the ordinary way that it is a poor operator indeed that fails to secure on a testing machine the elastic limit above one-half of the ultimate strength.

The writer is inclined to believe that there is no great need for noting the reduction of area in addition to the elongation. It is true that it adds but little trouble in recording the test, as it does not necessitate an extra setting of the slide rule.

While the Association of American Steel Manufacturers' specifies a minimum elongation of 26 per cent in 8 in. the Master Mechanics' Association specifications and those of nine railroads drop this to 22 per cent, and one company even lowers it to 20 per cent. This I am sure is not wise. What is needed for fire-boxes is a ductile steel, and an elongation of 24 per cent is certainly none too low. The 1,450,000

T. S. of the Pennsylvania Railroad is equivalent to 26⁴ per cent for 55,000 lbs. T. S. and 22.3 per cent for 65,000 lbs. T. S. There is good logic in this sliding scale but it is cumbersome.

It seems a mistake to admit thin plates of higher tensile strength and lower elongation than is required for thicker plates. Of course this is necessary if rigid chemical requirements are made, but it is more reasonable to require that thin plates shall be more, rather than less, ductile than thick ones, for the tendency to crack from a rivet hole is greater in a thin plate than a thick one.

It seems hardly necessary to specify the limits for all the different elements entering into steel and at the same time make rigid physical requirements. The writer is strongly in favor of limiting the amount of phosphorus and sulphur in the steel and likewise the amount of manganese, but believes that it is unnecessary for the buyer to go further than this. Excesses of these three elements tend to make the steel unreliable. Steel high in phosphorus may give a satisfactory test but surface inspection will discover numerous pits and scales on the plates, and while some plates may look smooth the inequalities of the steel will develop in service. The same is true of sulphur and manganese in differing degrees.

Several correspondents have spoken of plates failing in service, which plates when analyzed were found to be high in either phosphorus or sulphur or both.

The limits of phosphorus and sulphur should not exceed .03 per cent in each case. The limits of .35 per cent to .50 per cent for manganese adopted by the Illinois Steel Co. is good.

The very general consensus of opinion favors steel rather than iron plates, even if it were possible to get iron of uniformly high grade. The Chicago, Burlington & Quincy Railroad tried "sligo iron fire-boxes in the '70s with poor results, and this seems to be the experience of a large number of roads. The New York, Ontario & Western Railway has in service now a locomotive built by the Baldwin Locomotive Works in 1872 with 16x24 in. cylinders, and 63 in. driving wheels, which still has its original fire-box of "Bay State steel" and this box is apparently in as good shape now as ever. This engine is still running in the regular passenger train service.

Too much stress cannot be laid upon the importance of making hot and cold and quench bending tests upon steel for boilers and fire-boxes. These tests are easily made and unquestionably they are as important as the more elaborate tensile tests.

Where it is desired to get the very best plates possible it should be required that test specimens be cut both lengthwise and crosswise of the plate for bending. Often it is found that plates which will show a good test in the direction of rolling will fail completely in a transverse test. Indeed, it would seem best to have all tests cut transverse to the direction of rolling, as in case a defective ingot was used the transverse tests would show the fact more certainly, and the steel is always weakest in this direction.

There is always a marked difference in the tests taken from the two extreme ends of a long plate. This difference is frequently as much as 3,000 or 4,000 lbs. in the tensile strength. While the test from one end would pass the plate the test from the other end would not.

The homogeneity test is also a very excellent one and

should always be made for both boiler shell and fire-box plates.

A prominent boiler maker gives the following statements regarding charcoal iron:

"There is no question as to the relative qualities of iron and steel with regard to corrosion, the advantage being in favor of the iron. Charcoal iron flues are better than steel flues for certain waters. On the other hand, it is very hard to secure a pure charcoal iron flue at the present time, and a first-class open hearth steel flue is even better than the very best charcoal iron in many instances."

He further states that he has on file a letter from one of the highest price tube manufacturers stating that the so-called "charcoal iron tubes" which they make are not charcoal iron at all, and if such a thing is wanted their customer must wait while they run through a special order at an increase of 40 per cent in the price. This leads our correspondent to believe that a good quality of steel is to be preferred to any of the so-called charcoal iron tubes on the market, since the latter are not made in sufficient quantities to insure good quality of material.

Iron is unquestionably to be preferred for stay bolts and rivets, but this paper is intended to treat of plates only.

SPECIFICATIONS OF THE ILLINOIS STEEL CO. FOR STEEL PLATES

ADOPTED, NOVEMBER, 1895.

All tests to be pulled in an original section of eight inches with an original area of not less than one-half of a square inch. Test pieces to be carefully fitted up, having parallel sides with edges drawn filed. At least two tests should be taken from each ingot: one for tension, one for bending.

QUALITY.	CHEMICAL REQUIREMENTS.			
	CARBON.	MANGANESE.	SULPHUR.	PHOSPHORUS.
Fire-box.	.16	.35 to .50	Not over .040	Not over .020
Boiler.	.18	.35 to .50	" " .045	" " .040
Flange.	.18	.35 to .50	" " .045	" " .040
Ship.	.15	.35 to .50	" " .060	" " .080
Tank.	.10	.40	" " 100	" " 120

QUALITY.	ULT. ST. ST.	PHYSICAL REQUIREMENTS.			
		ELASTIC LIMIT.	ELONGATION.	BEND TEST.	QUENCH TEST.
Fire-box.	50,000	Not less than 1/4 ultimate strength.	Not less than 25 per cent.	All tests up to 1/4 inch thick must stand cold bending double and flattened down upon itself without cracking.	Tests must stand cold bending double after being heated whose inner surface is equal and quenched in water at 80° Fahr.
	60,000	Not less than 1/4 ultimate strength.	Not less than 25 per cent.	One test from each heat shall stand cold bending flat upon itself without cracking.	Heat test shall stand cold bending over a curve whose inner radius is equal to its thickness.
Boiler.	52,000	Not less than 1/4 ultimate strength.	Not less than 25 per cent.	All tests up to 1/4 inch thick must stand cold bending double and flattened down upon itself without cracking.	Tests must stand cold bending double after being heated whose inner surface is equal and quenched in water at 80° Fahr.
	65,000	Not less than 1/4 ultimate strength.	Not less than 25 per cent.	One test from each heat shall stand cold bending flat upon itself without cracking.	Heat test shall stand cold bending over a curve whose inner radius is equal to its thickness.
Flange.	52,000	Not less than 1/4 ultimate strength.	Not less than 25 per cent.	All tests up to 1/4 inch thick must stand cold bending double and flattened down upon itself without cracking.	Tests must stand cold bending double after being heated whose inner surface is equal and quenched in water at 80° Fahr.
	65,000	Not less than 1/4 ultimate strength.	Not less than 25 per cent.	One test from each heat shall stand cold bending flat upon itself without cracking.	Heat test shall stand cold bending over a curve whose inner radius is equal to its thickness.
Ship.	53,000	Not less than 1/4 ultimate strength.	Not less than 25 per cent.	All tests up to 1/4 inch thick must stand cold bending double and flattened down upon itself without cracking.	Tests must stand cold bending double after being heated whose inner surface is equal and quenched in water at 80° Fahr.
	68,000	Not less than 1/4 ultimate strength.	Not less than 25 per cent.	One test from each heat shall stand cold bending flat upon itself without cracking.	Heat test shall stand cold bending over a curve whose inner radius is equal to its thickness.
Tank.	Not over 72,000	Not less than 1/4 ultimate strength.	Not less than 20 per cent.	All tests up to 1/4 inch thick must stand cold bending double and flattened down upon itself without cracking.	Tests must stand cold bending double after being heated whose inner surface is equal and quenched in water at 80° Fahr.

REGULAR ALLOWANCE FOR OVERWEIGHTS.

THICKNESS OF PLATE—INCHES.	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 3/4	2 and over
Width 72" or under... per cent.	10	9	8	7	6	5	4	4	3	3					
of 72" to 90" ... per cent.	11	9	8	7	6	5	4	4	3	3					
plate 90" to 120" ... per cent.				9	8	7	6	5	4	4					

SPECIAL ALLOWANCE FOR OVERWEIGHTS.

THICKNESS OF PLATE—INCHES.	3/16	1/4	5/16	3/8	7/16	1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 3/4	2 and over
Width 72" or under... per cent.	16	14	13	11	10	9	7	7	6	6					
of 72" to 90" ... per cent.	16	14	13	11	10	9	8	8	7	7					
plate 90" to 120" ... per cent.				15	13	11	10	9	8	7					

The above special overweights will be allowed, but in no case shall a plate be marked or billed above the regular allowance for overweight. Three per cent. overweight will be allowed on fire-box and boiler, five per cent. on all other plates. Bessemer steel may be used in tank plates if not otherwise specified, but must be made to tank specifications.

AMOUNT TO BE CUT OFF TOP END OF INGOT.

QUALITY.	SIZE OF INGOT—INCHES.							
	8x24	10x36	12x24	12x40	10x30	10x40	18x10	24x10
Fire-box... per cent.	20	22	23	23	25	25	26	26
Boiler... per cent.	14	15	16	16	18	18	18	20
Flange... per cent.	14	15	16	16	18	18	18	20

Ample margin must be allowed on each side of plate to avoid lamination.

Special inspection must be given to all fire-box, boiler and flange plate, and every plate to be stamped by the final inspector's private stamp.

THE SITUATION AT PULLMAN.

It is apparent that for some reason (the animus of which an examination of the letter files of the gentleman in question would probably reveal) Mr. Geo. M. Pullman and the industries with which he is connected constitute a never failing source of pungent paragraphing by the press in general. Even technical papers which are supposed to be exempt from

*From a paper read by Mr. T. L. Condon before the Western Society of Engineers.

such practices make common cause with the others, as witness the following from a contemporary:

The Pullman Palace Car Co., has added about 300 men to its shop forces at Pullman, Ill., in the last few weeks, but is reported to have reduced wages 15 per cent. It is further stated that the company is strictly enforcing the requirement that shop employes live in the town of Pullman.

A reference of the clipping to Mr. Pullman elicited the following reply.

The complete cessation of orders from railway companies for passenger or freight equipment affected us at Pullman as it did every car building interest in the country, many of them being obliged to suspend operations entirely. These conditions made it necessary for us during the summer to lay off a considerable number of men, but as the winter season came on and the number of cars requiring repairs was increased, we began to take on again quite a number of employes thus laid off, and during the last two weeks nearly 400 of them have again been placed on the rolls; the number of men employed at our Pullman shops on this date being 1578.

The scale of wages at Pullman is to-day the same as has been in effect for two and one-half years, and the question of any reduction has not been and is not now in contemplation. The best answer to the last statement in this clipping is the fact that 31 per cent of the employes of the Pullman shops at this date (December 1, 1896) live outside of Pullman.

CHAS. A. SWEET,
Secretary to President.

TWO SIMPLE GASOLINE ENGINES.

Among the concerns which have placed gas and gasoline engines upon the market is Fairbanks, Morse & Company, this company having embodied the experience of 16 years of experiment and research into the development of engines of which the accompanying illustrations represent two forms. The claims made for these machines are economy in operation, safety, durability and simplicity, and an examination of the details of construction makes it apparent that they have many special features which are not to be found in other engines of this type. The manufacturers in a catalog recently published compare the cost of running a 10 horse power steam engine for 10 hours under an average of one half the rated load, with that of doing the same work with the gasoline engine of the same nominal power, the total cost being \$2.08 for the steam engines as against \$.72 for the gasoline engine. A comparison of the cost of running 20 horse power steam and gasoline engines for their full power for ten hours is given as \$4.60 for the steam engine and \$1.90 for the gasoline engine, these figures being based on the price of coal at \$2.30 per ton, gasoline being figured at 8 cents per gallon. Aside from the advantage in cost of operation, the gasoline engine has the recommendation that it may be stopped in a moment and without causing any useless expense when not running. These engines have a special starter pump attached to the engine cylinder, which is very simple in operation and permits of the prompt and satisfactory starting of the engine. The gasoline reservoirs are placed below the level of the engines which renders it impossible for overflowing to occur. The gasoline is drawn into the cylinder by a pump and it is con-

fined at the pump until it is taken into the cylinder, only a few drops at a time being admitted. No carbureter is used and the charge is fired by an electric spark.

The bearings of the engines are of brass and phosphor bronze throughout. The crank shafts and connecting rods are forged of steel and are finished all over. The parts are made heavier than is considered entirely necessary for strength on account of the additional life which this feature of design will produce, and in the construction unusual care has been taken in the proportioning of the parts with a view of obtaining correct bearing surfaces and distributing the stresses in such a manner as to avoid excessive wear, the object being to "make an engine that will run from one year's end to another without stoppage or repairs." The makers state that a boy can be taught in a few hours so that he can give the engine



FIG. 1.—VERTICAL GASOLINE ENGINE, 21 H. P.

all the attendance that it requires. It uses only two valves, which are of the poppet type, and are protected from the heat by water jacketing. There is but one cam, which by means of a straight rod carried in suitable guides, operates the exhaust valve without the employment of small or delicate parts. The governor is attached to the hub of the fly wheel and acts directly on the exhaust valve. It relieves the engine from compression and simultaneously cuts off the supply of gas or gasoline when not required.

These engines can be worked with coal gas or oil gas, and in fact almost any form of gas, and also with gasoline. In the engravings two sizes of the engine are shown, the smaller in Fig. 1, being the two horse power size, and the larger, Fig. 2, representing the method of construction of the sizes for 40, 50 and 75 horse power, the one illustrated being a 75 horse power engine. The two horse power engine differs somewhat from the regular type in that the cylinder is vertical. The bearings and gears run in an oil bath, which also provides lubrication for the piston. This engine is equipped with a torch and also with

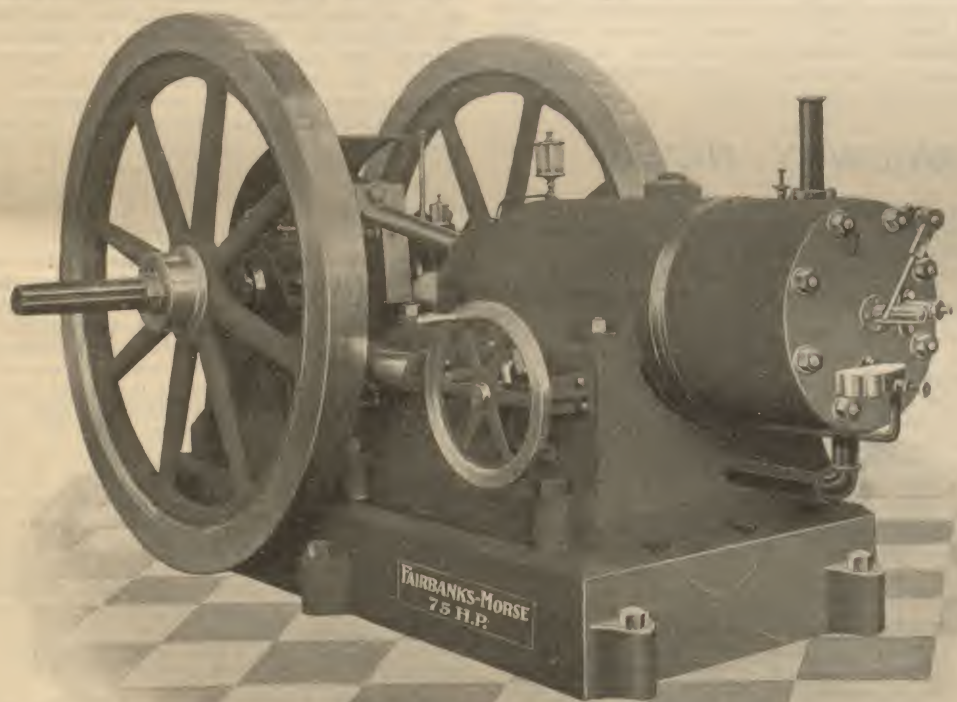


FIG. 2.—HORIZONTAL GASOLINE ENGINE, 75 H. P.

an electric igniter and it can be arranged to be run by gas when desired. This engine is started by means of a crank which is fixed to the end of the crank shaft of the engine instead of using the pump which is provided for the horizontal type. This engine can be geared for direct pumping, and ordinarily it is furnished with a 10x5 in. pulley.

TECHNICAL MEETINGS.

The annual convention of the American Society of Mechanical Engineers will be held at the house of the society 12 West Thirty-first street, New York City, December 1st to 4th, 1896. Secretary, F. R. Hutton.

The Engineers' Club of Cincinnati has a monthly meeting on the third Thursday in each month, at 7:30 p. m., at the Literary Club, 24 West Fourth street, Cincinnati, O. Address P. O. Box 333.

The Engineers' Club of Minneapolis holds its meetings on the first Thursday in each month, at Public Library building, Minneapolis, Minn.

The Engineers' Club of Philadelphia meets on the first and third Saturdays in each month, at 8 p. m., at the house of the club, 1122 Girard street, Philadelphia, Pa.

The Civil Engineers' Club of Cleveland, meets on the second and fourth Tuesdays in each month, at 8 p. m., at the Case Library building, Cleveland, Ohio.

The Association of Engineers of Virginia, holds its formal meetings on the third Wednesday of each month from September to May inclusive, at 8 p. m., at 710 Terry building, Roanoke, Va.

The Western Railway Club of Chicago, holds its meeting on the third Tuesday of each month.

The Central Railway Club meets on the second Friday of January, March, May, September and October, at 2 p. m., at the Hotel Iroquois, Buffalo, N. Y.

The Denver Society of Civil Engineers meets on the second and fourth Tuesdays in each month except July, August and December, when they are held on the second Tuesday only, at 36 Jacobson building, Denver, Colo.

The Western Society of Engineers holds its regular meetings for the transaction of business and the reading and discussion of papers on the first Wednesday of each month except January.

The American Society of Civil Engineers holds meetings on the first and third Wednesdays in each month, at 8 p. m., at the House of the Society, 127 East Twenty-third street New York City.

The Association of Civil Engineers of Cornell University meets weekly every Friday, from October to May inclusive, at 2:30 p. m., at Lincoln Hall, New York.

The Boston Society of Civil Engineers, meets monthly on the third Wednesday in each month, at 7:30 p. m., at Wesleyan Hall, 36 Bromfield street, Boston, Mass.

The Canadian Society of Civil Engineers meets every other Thursday at 8 p. m., at 112 Mansfield street, Montreal, P. Q.

The Foundrymen's Association meets monthly on the first Wednesday of each month, at the Manufacturers' Club, Philadelphia, Pa.

The Montana Society of Civil Engineers meets monthly on the third Saturday in each month, at 7:30 p. m., at Helena, Mont.

The New England Railroad Club meets on the second Tuesday of each month, at Wesleyan Hall, Bromfield street, Boston, Mass.

The New York Railroad Club has a monthly meeting on the third Thursday in each month, at 8 p. m., at 12 West thirty-first street, New York City.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m., at the St. Paul Union Station, St. Paul, Minn.

North-West Railway Club meets alternately at the West Hotel, Minneapolis, and the Ryan House, St. Paul, on the second Tuesday of each month.

The Engineering Association of the South meets on the second Thursday of each month at 8 p. m., at the Cumber and Publishing House, Nashville, Tenn.

The Railway Signaling Club holds its meetings in Chicago, Ill., on the second Tuesday of January, March, May, September and November. G. M. Basford, secretary, 818 The Rookery.

The Southern & Southwestern Railway Club holds its meetings on the third Thursday of January, April, August and November, at the Kimball House, Atlanta, Ga.

The Western Foundrymen's Association holds its meetings on the third Wednesday in each month, at the Great Northern Hotel, Chicago, Ill.; secretary, A. Sorge, Jr., 1533 Marquette building.

PERSONAL.

Mr. W. R. McIntosh has been appointed division freight agent of the Baltimore & Ohio, with headquarters at at Cumberland, Md.

Mr. H. P. Hathaway, of Louisville, has been appointed traveling agent of the Kanawha Dispatch, with headquarters at Chicago.

Mr. H. P. Plant, who on Tuesday last was re-elected president of the Southern Express Co. has held that position thirty-four years.

Mr. George P. Haskell, a passenger conductor on the Lima Northern, has been appointed assistant superintendent, with headquarters at Lima.

Mr. B. H. Daily has been made soliciting agent of the Star Union line at Milwaukee, and Mr. Z. D. Scott, traveling agent, with headquarters at Milwaukee.

Mr. Dwight Braman of New York has been appointed receiver of the St. Louis, Kansas City & Southwestern, and commences the operation of the road the present week.

The death of Mr. Myles Pennington was announced last week. Mr. Pennington was the first general manager of the Grand Trunk Railroad and was at his death eighty-two years old.

Mr. J. M. Johnson, freight traffic manager of the Chicago, Rock Island & Pacific was on December 1 elected chairman of the new rate committee of the Western Freight Association.

Mr. Wm. Quinn, trainmaster of the Cairo division, will succeed Mr. W. G. Bayley as superintendent of that division. The latter goes as superintendent on the St. Louis division, as mentioned last week.

Mr. W. C. Shoemaker has been chief clerk to Superintendent S. B. Floeter at Lima, has been appointed assistant superintendent of the Dayton & Michigan division of the Cincinnati, Hamilton & Dayton road.

Mr. E. Youngman has been appointed chief clerk of the advertising department of the Pennsylvania, vice Mr. D. N. Bell, who has gone to New England as general agent of the company in the passenger department.

Mr. E. F. Serviss has been appointed commercial agent for the Kansas City, Pittsburg & Gulf, vice Mr. W. F. Bellaire, resigned. Mr. Serviss has been the chief clerk in the general freight office for some years.

Mr. O. B. Bidwell has been made freight claim agent of the Seaboard Air Line with headquarters at Savannah, Ga. Mr. Bidwell, although a young man, is considered one of the rising railroad men of the southeast.

Mr. Andrew F. Burleigh has filed a petition with the federal court for his discharge as receiver of the Northern Pacific Railroad, having closed up the affairs at this end of the old company. Judge Hanford issued an order of discharge.

Mr. Frederic A. Allsion, chief train dispatcher of the Philadelphia, Reading & New England, died at Hartford, Conn., on Wednesday, November 30. He was well known through his prominence as one of the Order of Railway Telegraphers.

Receiver Malott, of the Vandalia, has issued an official circular appointing Mr. John G. Williams, late vice president of the Vandalia, general counsel; Mr. T. J. Golden of Marshall, Ill., assistant counsel, and Mr. E. R. Darrow as general agent.

Mr. C. L. Mayne has been appointed assistant general superintendent of the Fitchburg road, with headquarters at Fitchburg, and has assumed his duties. Mr. W. D. Ewing, formerly with the Evansville & Terre Haute, is general superintendent.

Mr. Screven Dozier, acting treasurer of the Florida Central & Peninsular Railroad, has been appointed treasurer of the road, the appointment to take effect December 1. The position was made vacant by the death of Mr. W. N. Thompson, which occurred September 30.

Mr. Frank E. Janowitz, coal traffic agent of the Baltimore & Ohio Southwestern, has resigned, and retires from the service of the company. Coal-traffic manager W. W. Peabody, Jr., has appointed Mr. R. S. McVeigh traveling agent of the coal-traffic department of the same road.

Announcement is made that on Dec. 1 Mr. J. W. Trounce, 966 Elliott square, Buffalo, assumed the duties of car accountant of the Buffalo & Susquehanna road. Reports of movement and mileage of Buffalo & Susquehanna cars, formerly sent to Mr. C. W. Cushman, will hereafter be sent to Mr. Trounce.

Mr. T. L. Ferguson, city passenger agent of the Chicago & Northwestern in Chicago, has been appointed assistant general passenger agent, a new position. He will have charge of local business, Assistant General Passenger Agent Firms having charge of foreign business. Mr. Ferguson is succeeded by Mr. W. M. Dodd, cashier of the general ticket office.

Mr. James N. Brown, formerly assistant general passenger agent of the Union Pacific Railroad at Omaha, and previous to that a clerk in the general office of the Chicago & Grand Trunk, died this week at a sanitarium in Detroit where he had gone for an operation. At the time of his death he was in the employ of the passenger department of the Minneapolis & St. Louis road.

Under date of November 30, the board of directors of the Maine Central R. makes official announcement that Mr. Geo. F. Evans will discharge the duties of general manager of the company, vice Mr. Payson Tucker. He will have general charge of the business and affairs of the company, and of the maintenance and operation of its railroads and property, under the direction of the president and the board of directors or executive committee.

Mr. Augustine A. Heard on January 1, 1897, will become western passenger agent of the Lehigh Valley road. In March, 1895, Mr. Heard resigned his position as assistant general passenger agent of the Missouri Pacific to become general passenger agent of the Northern Steamship Co., and general eastern passenger agent of the Great Northern Railway with headquarters at Buffalo. In September of 1896 he also resigned from this position and secured the position of secretary of the Central Passenger Committee which office he now holds.

Mr. Robert E. Marshall, superintendent of the Altoona division of the Pennsylvania Railroad committed suicide on Monday morning of this week by shooting himself at the home of his brother in Washington, D. C. For some time Mr. Marshall has suffered from acute nervous troubles resulting from overwork, and it is to this that the tragedy is attributed. He was a son of Mr. J. W. Marshall, at one time a professor at Carlisle College, Pennsylvania, consul to Leeds during the war and assistant postmaster general under President Grant. He was thirty-four years of age.

Some changes have been lately made on the Cleveland, Cincinnati, Chicago & St. Louis road whereby Mr. H. F. Houghton, assistant superintendent, with offices at Indianapolis, will have charge of transportation of entire Chicago division; Mr. Thomas Reynolds, trainmaster, with office in Cincinnati, will have charge east of Indianapolis; and Mr. O. W. Beckwith, trainmaster, with offices at Kankakee, will be in charge west of Indianapolis. Mr. Beckwith recently left Kankakee as trainmaster of the Chicago division of the Big Four to take a similar position on the Cincinnati & Sandusky divisions of the Big Four under Division Superintendent English, but now returns to his former position.

Mr. C. R. Capron, contracting freight agent of the Great Northern road at St. Paul, has resigned and the office will be abolished. Mr. Capron is one of the best known and best liked railroad men in the local field of the north west. Before coming here he was general agent of the Chicago, Milwaukee & St. Paul in Chicago, and before that was general freight and passenger agent of the Winona & Western with headquarters at Winona. His connection with the Great Northern as contracting freight agent in St. Paul covers a period of over two years. Mr. S. A. Willard, who recently came from the Minneapolis office to St. Paul as general agent of the local freight department, will absorb the duties heretofore performed by Mr. Capron.

Mr. Payson Tucker, vice president and general manager of the Maine Central Railroad, was on Nov. 30 relieved of those offices by the Maine Central Railroad directors by a majority vote, and Mr. George F. Evans was elected general manager. This change in management has been the cause of much speculation, and the only explanation so far made public for the deposition of Mr. Tucker is that given by President Wilson of the Maine Central, who says: "There were differences of opinion existing between the directors of the Maine Central and Mr. Payson Tucker, and the board elected G. F. Evans general manager, but Mr. Tucker remains a director of the road and vice president. The influence and labor of Mr. Tucker in bringing the road to its present state of efficiency are fully appreciated by the owners of the property and by the general public, and all will be glad to know that the company is still to have the benefit of Mr. Tucker's advice."

Mr. E. B. Byington, who since March, 1892, has held the position of general western passenger agent for the Lehigh Valley road with headquarters at Buffalo, will on January 1, 1897, retire from that position. Mr. Byington it is understood, will have the supervision of outside agencies. The change is made to relieve him of duties which were becoming too exacting for his age and the condition of his health. Mr. Byington's first railroad service was with the Erie road as northwestern passenger agent at Milwaukee, from 1850 to 1861, and for the following year he was general agent of the Vermont Central and Grand Trunk roads at the same place. In 1863 he became general southern agent of the Chicago & Alton road and Memphis & St. Louis Packet Co., at Memphis, where he remained one year. He then became general passenger and ticket agent for the Packet Company, and ticket agent for all roads centering in St. Louis, which position he retained from 1863 to 1872. Since 1875 he has been with the Lehigh Valley, first as general northern agent, then as general passenger agent and general western passenger agent, which position he now resigns.

RAILWAY NEWS.

Charleston, Clendenin & Sutton.—Work which was discontinued on August 1, on the construction of the Charleston, Clendenin & Sutton road will be resumed at once. The road is now completed and in partial operation from Charleston, W. Va., nearly to Clay Court House and it is thought one month of active work will complete the line to that point. Rolling stock has been ordered which will be sufficient to run trains regularly. It is expected the line will immediately be extended to Sutton, where connection will be made with the West Virginia & Pittsburgh, forming a connecting link through valuable undeveloped timber and coal lands of West Virginia, between the Kanawha & Michigan, the Chesapeake & Ohio, and the Baltimore & Ohio roads. The distance from Charleston to Sutton is about 110 miles along the Elk river valley, and throughout the route the road passes through a fine coal and timber country. Governor McCorkle is president of the company, and is at the head of a syndicate that will develop the coal and timber along the line.

Chicago & Eastern Illinois—Chicago, Paducah & Memphis.—On the first of December the Chicago, Paducah & Memphis passed into the hands of the Chicago & Eastern Illinois and will hereafter be operated as a part of that system. By the first of January it is hoped the new connecting line between Shelbyville and Altamont will be completed thus making it a through line from Chicago to Marion. It is said that the people along the line in this section are greatly elated over the purchase and consolidation, as it gives them a direct outlet to the Chicago and

southern markets. The road, under the new system, will be a formidable competitor of the Illinois Central Railroad Co.

Duluth, Superior & Western.—The organization of this company, which is practically a reorganization of the old Duluth & Winnipeg, was completed on November 24 at a meeting at Duluth. The stockholders were represented by Mr. M. D. Munn of St. Paul, and he was empowered to vote the stock of the old corporation to the new, said to be about \$1,500,000. Mr. W. F. Fitch was elected president and Treasurer E. W. Allen, of the Duluth, South Shore & Atlantic, was elected treasurer of the new company. Mr. A. B. Eldridge is general counsel and Mr. A. E. Delf, auditor.

Kansas City, Pittsburg & Gulf.—It is expected that the gap in the Kansas City, Pittsburg & Gulf R. at Mena, Ark., will be completed by December 20, and the entire force of 3,000 men employed there will be transferred to the southern end of the line and the work will be pushed to the utmost. The bridges across the Neches and Sabine rivers are almost ready to put in and the track from Beaumont to the Sabine river can be laid in 30 days. The bridge at Beaumont will be commenced next week. This company has at present 531 miles in operation, and if possible the whole line will be completed by January 1 of next year, the distance being 780 miles. The road is being built by the Missouri, Kansas & Texas Trust Co. of Kansas City, by means of several construction companies. The railroad has an authorized capital of \$20,000,000 stock and \$20,000,000 bonds, though stock and bonds now outstanding only amount to about \$12,000,000 each. The bonds are 30-year 5 per cent gold bonds. The stock is quoted between 18 and 20 on the Philadelphia stock exchange and the bonds between 70 and 80, but as most of the stock and bonds are "pooled" there is not much floating stock on the market. These bonds are paid to stockholders of the various construction companies as dividends. For every 10 miles of road built a dividend of stock and bonds is declared, so that when the road is completed the stockholders in the construction companies become the owners of the road, besides retaining their interest in the town sites and bonuses due the construction companies. Under the terms of agreement with the construction companies the interest on bonds, which have been issued at the rate of \$25,000 per mile on the road constructed by the Arkansas Construction and Philadelphia Construction Companies will be paid October, 1897, and on October, 1898, on road constructed by the Kansas City Terminal Construction Co. The capital used in building the road has been primarily subscribed in Holland, but investors in New York, Philadelphia, Boston and several New England towns have considerable investments in the railroad and construction companies and the varied allied corporations. The company has planned extensive terminals at Port Arthur, on Sabine lake near the Gulf of Mexico. According to Mr. J. Van Shouwenberg, one of the Holland syndicate, \$1,500,000 will be expended on the docks and buildings and in dredging a ship channel through Sabine lake. Mr. Lunden C. Bates of Chicago, it is stated, has the contract to build a large dredgeboat for this purpose. The road has no floating debt. It is principally rock ballasted, and 60 lb. steel rails have been laid. Brick and stone stations have been built at the prominent towns.

Minneapolis, St. Paul & Sault Ste Marie.—A suit which has been pending in the circuit court at Gladstone, Mich., in which the Soo line was defendant, has been decided adversely to that road, and a verdict of six cents damages was granted to the plaintiffs, which carries the costs. In 1887 the railroad company laid several tracks across the Marble addition, 40 acres of land lying near the center of the city, but neglected to negotiate with the owners for right of way. This has been in controversy in the circuit court for some years, but a plat has been filed in which the tracks of the "Soo" were shown and the streets of the addition laid out to correspond with their curves and angles. This was relied upon by the railway company as showing their right to use the land occupied. Precedent was against the company, however, and the owners of the land got their writ of ejectment against the railway company. Whether the company appeals to the supreme court or not it is an unpleasant predicament as the tracks in question are the only approach to the great flour and coal docks, elevators, etc., of Gladstone.

Oregon Short Line & Utah Northern.—On December 1 a decree was handed down in the two cases in which the Oregon Short Line & Utah Northern and others are defendants. The decree adjudges that within five days after Dec. 1 the Oregon Short Line & Utah Northern must pay to the clerk of the federal court the sum of \$2,417,516, otherwise the lines embraced in the system will be sold at public auction to the highest bidder for cash. Judge Sanborn in his decree appoints Mr. Wm. D. Cornish of St. Paul as special master to take charge of the affairs of the company immediately upon its failure to pay over the amount decreed by the court. After the sale occurs, the reorganization committee will assume control of the company which will hereafter be known as the Oregon Short Line & Utah Northern Rd., the last word being changed from railway. According to statements said to have been made by Managing Receiver Clark, the Oregon Short Line segregation from the Union Pacific system will take place in February, at which time all connection between the parent road and the 1,100 mile branch will be severed.

Philadelphia & Reading.—At 12 o'clock, midnight, of November 30, the old Philadelphia & Reading Railroad Co. ceased to exist and the Philadelphia & Reading Railway Co. took its place. At the hour named the receivers—Joseph S. Harris, John Lowber Welch and Edward M. Paxson—without formality turned over all the railroads and franchises in their possession and ceased to operate the

Properties. The event, although marking an important epoch in the history of the road, passed without ceremony and with the same routine that characterizes the movements from day to day. The Reading R. Co., it is understood, has made a deed to Messrs. Coster & Stetson, and these gentlemen have executed a deed to the Philadelphia & Reading Ry. Co. transferring the property to them, but in view of the fact that the Coal & Iron Company was not sold at the foreclosure sale as was the railroad company, it was not necessary to go through the same legal routine in making the transfer, and its property and franchises, therefore, were deeded by the purchasers to the new company. President Harris issued a circular in which it was stated that First Vice President Voorhees, besides having charge of the operation of the railroad, would also have jurisdiction over the passenger business. Second Vice President Henderson is to have charge of all freight business. It has not yet been given out when the securities of the new company will be ready for issue. They include \$114,000,000 general mortgage 100-year 4 per cent gold bonds, \$28,000,000 non-cumulative 4 per cent preferred stock, \$42,000,000 non-cumulative 4 per cent second preferred stock and \$70,000,000 common stock.

Roanoke & Southern.—According to announcements made several weeks ago, the Roanoke & Southern road was on November 24, sold at Winston, N. C., under foreclosure sale by Special Masters Bowden & Sharp of Norfolk, Va. It was purchased by Mr. Wm. E. Glynn, representing a party of Philadelphia and New York capitalists, his bid being the only one offered. It is said that the sale has a much greater significance than appears upon the surface. The new company will organize at once under the name of the Norfolk, Roanoke & Southern Railroad Co., and the property will then be leased to the Norfolk & Western Railroad Co. In speaking of the deal an exchange says: "The object of the acquisition by the Norfolk & Western means that it is to play an important part in the extensions of that company, which has for its object the reaching of the central and important points. The present management of the Norfolk & Western is desirous of securing an entrance to Atlanta, from which important center it is virtually shut out. It is proposed to attain that object by forming a close traffic alliance with the Seaboard Air Line. In order to make this move complete it will be necessary for the Norfolk & Western to do some building on its own account, and this it promises to do in the very near future. The Roanoke & Southern terminus is at Winston. By building an extension to Monroe on the Seaboard Air Line, the desired connection can be made, and the Norfolk & Western will then be only 272 miles away from Atlanta. That the Seaboard Air Line management will see the mutual benefits from an alliance and will enter upon the same is undoubted, if for no other reason than an outlet to the north and west is created which would doubtless form a formidable rival for southern trade. The Seaboard Air Line has some very interesting plans of development ahead. The consummation of the proposed plans is a matter of the near future. The Norfolk & Western intends to be a stronger bidder for Southern business, of which Atlanta is the common distributing point."

St. Louis, Kansas & Southwestern.—A receiver was last week appointed for the St. Louis, Kansas City & Southwestern upon application of the Farmers' Loan & Trust Co. of New York. The company owns a line 60 miles in length, running from Arkansas City to Anthony, Kan. The road has been operated by the St. Louis & San Francisco Co. up to six weeks ago, when it was abandoned, as the managers of the "Frisco" were operating it at a loss. The Farmers' Loan & Trust Co. holds \$890,000 of the company's bonds, upon which interest is in default. Mr. Dwight Braman of Boston, who was named as receiver, filed the suit recently begun in St. Louis to set aside the proceedings which resulted in the reorganization of the "Frisco" property, and is admittedly opposed to the present management of that road.

San Antonio & Gulf Shore.—The sale of the San Antonio & Gulf Shore R., was confirmed by Judge R. B. Green on November 28. This road was purchased on the 7th of July last at receiver's sale by Mr. Oscar Bergstrom for the sum of \$150,000, of which one-fourth was paid in cash and the balance to be paid at the confirmation of the sale. The order of the court provides that the purchaser pay the remaining \$112,500 as fast as the claims against the road are adjudicated, all to be paid within twelve months. This is in accordance with a suggestion made by the purchaser. In the meantime the road is taken out of the hands of the receiver and will be operated by the purchaser.

Terre Haute & Indianapolis—Indiana & Lake Michigan.—A bill of complaint was filed in the United States district court, Nov. 27, against the Terre Haute & Indianapolis R. and the Indiana & Lake Michigan R. asking for the appointment of a receiver the latter road so that it may be sold to satisfy a debt of \$12,000 due to the Central Trust Co., of New York and the holders of bonds. The road is a little more than 39 miles in length and runs between South Bend, Ind., and St. Joseph, Mich. In the early part of 1888 the Indiana & Lake Michigan of Indiana and the Indiana & Lake Michigan of Michigan were consolidated into one company, the capital stock of the consolidated company being fixed at \$800,000. The road was partially built under a contract which gave the contractors all of the capital stock and \$480,000 first mortgage 5 per cent bonds. In 1890 the uncompleted line was turned over to the Terre Haute & Indianapolis that company guaranteeing principal and interest of the bonds and agreeing to operate the road for 99 years for seventy-five per cent of the gross earnings, the remaining twenty-five per cent to be applied to taxes, interest and organizing expenses. The

road failed to make the regular September payment on \$480,000 borrowed from the Central Trust Co., and hence the complaint asking for the appointment of a receiver and the sale of the two roads was made. The application for a receiver of this road is the result of the appointment a few days ago Volney T. Malott as receiver for the Terre Haute & Indianapolis R.

Union Pacific, Denver & Gulf.—It is given out that the various lines of the entire Gulf system are to be taken out of the receivers' hands, and to that end Gen. Granville M. Dodge president of the Fort Worth & Denver City has been making a tour over the system. It is said that the Union Pacific Denver & Gulf, the Denver, Leadville & Gunnison, the Cheyenne & Northern the Denver & Pacific, the Denver, Texas & Ft. Worth and the Colorado Central railroads will be joined into one company. Complete severance of the Gulf system from the Union Pacific influences means a great deal to Colorado in the development of the trade via Galveston and southern ports.

NEW ROADS AND PROJECTS.

Canada.—Mr. A. G. Blair, minister of railways and canals of Canada, has gone to Lethbridge, N. W. T., to inspect the proposed route forming the much talked of extension of the Canadian Pacific to Crow's Nest pass into the mining territory of Canada. The investigation comprehends the tapping of the great gold fields of southern British Columbia by a complete system of railway lines in one of the most tortuous regions for railroad building in the world. The new lines will connect directly with the Canadian Pacific R. and will put the gold mines and the hundreds of thousands of acres of rich bituminous coal lands in direct connection with the great northwestern trunk lines. The undertaking involves an expenditure of some \$8,000,000.

Indiana.—Articles of association have been filed with the secretary of state, which provides for the building of a new road to traverse the entire oil region of the state of Indiana. It will be called the Chicago, Bluffton & Cincinnati and the proposed route is from Union City to a point on the Baltimore & Ohio near Milford Junction. An exchange says: "It practically the same line with all the rights and franchises of the old defunct C., U. C. & C., but is backed by parties who have capital enough to carry out their plans. Parties interested in the project have made a thorough investigation and are satisfied that the route is a good one. Messrs. Hugh Dougherty and A. L. Sharpe, Bluffton bankers, and Judge N. W. Bliss and F. W. Short, of Chicago, are a few of the prominent capitalists behind the scheme."

It is stated that early in 1897 construction of the Ashley, Kendallville & Peru R. will begin. The line, which will be about 70 miles in length has already been surveyed, and runs from Ashley to Chili.

Louisiana.—A survey has just been made for a new line to connect Baton Rouge and Simmesport, a distance of 65 miles, and on January 28 next an election will be held at Alexandria to vote upon aid to be extended to the project in the form of a five-mill tax. At Simmesport connection will be made with the St. Louis, Avoyelles & Southwestern to Marksville, from which point it is proposed to build to Alexandria, about 25 miles. The company promises to have the road ready for operation by January 1, 1898.

Minnesota.—The survey which is being made by the Great Northern for the extension of the Fosston branch, has crossed the Duluth & Winnipeg line at Deer River and it is reported that the survey will be continued into the Mesaba range. The supposition has been that after striking the D. & W. line at Deer river that the tracks of that company would be used from that point into Duluth and the indicated paralleling of routes is unexplained at present. The estimated cost for construction is about \$15,000 per mile.

North Carolina.—A plan is being formulated for the building of a new line to connect Washington and Newbern, N. C., and surveys are now in progress. The proposed line would be an extension of the Atlantic Coast Line which has its terminus at Washington, and connection would be made at Newbern with the Wilmington, Newbern & Norfolk, thus making a new route between Norfolk and Wilmington which would be much shorter than the present line. The new road would enter the trucking section of eastern North Carolina and compete with the Norfolk & Southern Railroad.

Oklahoma.—Engineers have been laying out a route for a new line from Arnettville, a place about six miles north of Perry, to Stillwater, a distance of some 30 miles, and it is expected work will begin within the next sixty days. The road will be built by the Santa Fe, and the people of Stillwater propose to furnish most of the money to do the grading. It is contemplated that the Santa Fe will run the road into the coal fields near South McAlester.

INDUSTRIAL NOTES.

Cars and Locomotives.

—The Wilmington & Northern Railroad is asking bids upon 200 to 300 cars.

—The Duluth, Mesaba & Northern is shortly to be in the market for some additional ore cars.

—The Southern Pacific Company has purchased eight old Pullman cars and is changing them into day coaches. It is stated that the wood and iron work of the Pullman cars are of such excellent material that the framework can be used for many years after the balance of the car is worn out.

—It is probable that the St. Louis & San Francisco will shortly be in the market for from 300 to 400 coal cars however, the matter has not yet been definitely decided upon.

—The Lebanon Mfg. Company of Lebanon is just completing an order of 500 hopper bottom gondola cars of 60,000 lbs. capacity for the Philadelphia & Reading Railway.

—The announcement that contracts are to be given out shortly for 1,000 cars for one of the private lines operating over the Baltimore & Ohio Railroad is somewhat premature. The order is hung up for the present. The equipment when built will be on Baltimore & Ohio specifications.

—The Schenectady Locomotive Works are building for the Northern Pacific Railway Company four mastadon or twelve wheel compound locomotives which will be the most powerful engines of this type ever constructed. The engines are of the Schenectady two cylinder compound type, the high pressure cylinder being 23 in. and the low pressure 34 in. in diameter, with a stroke of 30 in. The cylinders are fitted with the new intercepting valve, designed by the Schenectady Locomotive Works, which enables the engine to be operated as a simple or compound at will, this device now being in very successful use. The weight of the engine will be about 180,000 lbs., with 148,000 lbs. on drivers. The driving wheel centers are of cast steel 48 in. in diameter, which with 3½ in. tire makes the diameter of drivers 55 in. The boiler is of the extended wagon top type, 72 in. at front end; has a larger heating surface than ever used in locomotive practice, and is built to carry a working pressure of 200 lbs.

Bridges.

—Before approving the appropriations asked by the Bureau of Surveys, the Councils' Survey Committee settled on \$400,000 as the amount to be set aside for a new bridge at Gray's Ferry. In the original item \$400,000 was appropriated on condition that the Pennsylvania Railroad should provide \$75,000 additional. Application was made to have the city appropriation raised to \$500,000 and the proviso omitted. The committee decided to omit the proviso, but did not increase the item.

—The Atchison, Topeka & Santa Fe Ry. Co. is reported to have awarded the contract for constructing 68 iron bridges along its line to the American Bridge Works, Chicago, Ill. Several of the structures will each be about 163 ft. long. It is also stated that the contract for the masonry work for these bridges has not yet been awarded, but probably will be in a few weeks.

—The New York & New Jersey Bridge Construction Co. is reported to have made a contract with the Union Bridge Co. of New York to build a bridge over the Hudson river at a cost not to exceed \$25,000,000. The Union Bridge Co. gave a bond of \$1,000,000 for the faithful performance of the contract. Secretary Swan, of the New York & New Jersey Bridge Co. says that his company will soon be in a position to place on the market the bonds for the construction of the bridge and its approaches. It is the purpose of the company that the bridge shall have eight railroad tracks. When the bridge is completed the Pennsylvania Railroad expects to run its cars into the city.

—The Marietta & Williamstown Bridge Co. was incorporated Nov. 18 at Allegheny, Pa., with a capital stock of \$400,000, commencing with \$100,000. The company is organized to construct the proposed railway bridge previously noted in these columns.

—George R. Eastham and J. G. H. Miller have been appointed commissioners to advertise for bids on the construction of a double track iron and steel bridge at Elkton, Va., to cost about \$7,500.

—Work on the new bridge across the Monongahela river at Rankin, has been commenced. It will virtually join the two great mill towns of Braddock and Homestead. Traffic between those two points now has to be done by traversing about five or six miles roundabout or crossing the river by ferry. It will also greatly shorten the distance between Pittsburgh and Braddock. The new bridge is 2,200 ft. long, with a central span of 750 ft. and two side spans of 350 ft. each. The approaches will cross the Baltimore & Ohio, Pittsburgh, Virginia & Charleston and Union railroads overhead, and the bridge will be one of the highest on the Monongahela river.

—In accordance with an order of the United States circuit court the work of reconstructing the entire north approach of the K. & I. bridge, which is on the New Albany side, will soon be begun. The work will cost \$35,000, as the new approach will be built of steel. The court orders that the work be completed by May 1, next. On Dec. 2 Judge Barr, at Louisville, ordered the preparation of a decree of sale of the Kentucky & Indiana Bridge Company properties, which include the approaches on both sides of the river, the New Albany Street Railway Company and the New Albany Belt Railroad. The value of the whole is over \$3,000,000 and the claim of the first mortgage bondholders is given priority over all other claims. An impression prevails that the Southern Railway will secure control of the property and lease to other lines now operating over the bridge.

—The city council of Menominee, Wis., has accepted plans and specifications for a new steel bridge to connect with Marinette, the estimated cost of which will be \$9,500.

—One bridge over the Missouri Pacific Railroad tracks, of 100 feet span, at Kirkwood, Mo., will probably be constructed this winter.

—An ordinance directing the department of public works to prepare a plan for the new bridge across the

Schuylkill river near Gray's Ferry, the cost not to exceed \$500,000, was considered by the survey committee Nov. 18, and as plans had already been prepared, the ordinance was sent to the finance committee with a request that it insert the amount \$400,000 in the annual appropriation.

The highway commissioners of Medina, New York have decided that a new steel bridge over Oak Orchard creek must be constructed.

It is stated that the work of completing the new bridge across Wreck Lead, Long Beach, L. I., is progressing rapidly. The board of supervisors having sanctioned the erection of the bridge at its last meeting, the consent of the war department will be obtained at once and the draw placed in position. The draw opening will be considerably wider than that of the railway bridge just below it, and the baymen will, therefore, make no objection to it.

It is reported that the commissioners of St. Johnsville and Minden, New York, are prepared to receive plans and specifications for a new iron bridge over the Mohawk river, work on which is expected to be begun this year.

Bids are asked until Jan. 11 (postponement from Nov. 16), for constructing a double track iron and steel bridge over Flint river at Albany, Ga. The structure will have two spans of 140 feet each. W. O. Watson, chairman of board.

Buildings.

The Slaymaker Barry Co., at Connellsville, Pa., is preparing plans and receiving bids for the erection of an addition to the works in shape of an iron foundry for the purpose of making all its metal castings, which it has hitherto bought in the open market. The foundry will be a brick building.

The Illinois Central Railroad has purchased for \$115,000 the property adjoining its Union passenger station on the river front at Louisville, Ky., to erect a duplicate of its train shed, which is used by six roads. This will make one of the largest passenger stations in the United States.

The Philadelphia, Wilmington & Baltimore Railroad Co. has purchased twelve acres of land in South Wilmington, Del., and the rumor that the company will erect more car building shops has been revived.

The Detroit Steel Springs Works has resumed active operations with a full force.

The Missouri Malleable Iron Co. of East St. Louis, Ill., has broken ground for an addition to its annealing room, and intends putting in enough additional ovens to increase the capacity one-third. Should business continue to improve at the present rate the company expects to have to increase other departments during the course of the winter. It has recently closed another contract with the Trojan Car Coupler Co. for a large number of "Trojan" couplers.

It is stated that plans have been completed for the enlargement of the Louisville & Nashville Railroad Co.'s shops at Decatur, Ala.

The Cambria Iron Co. of Johnstown, Pa., which begun the erection of a beam mill some six months ago, when business was active, is now pushing the work, and the company reports that it will be running in a few weeks, when it will be in the market for the sale of all sizes of steel I-beams in connection with the other structural products of the works. The company is also increasing its open hearth plant, so that the product of that character of steel will be much larger than heretofore.

It is announced that the Soo line has secured grounds at Minneapolis for terminals and will have freight houses and tracks constructed and ready for use by November 1, 1897, to cost \$250,000. The plans for the buildings will be prepared the latter part of the winter, and in the meantime experts will be occupied in studying the best systems of arrangement for the terminals.

The Charleston & Western Carolina Railway will build a grain elevator and extend its warehouse facilities at Port Royal, S. C.

It is reported that bids are being received by the Baltimore & Ohio Railroad Co. for constructing roofs over piers 62 and 63, Philadelphia, Pa. The piers are 46 and 36 ft. wide, respectively, and the length of each is 643 ft. The roof for each pier will cost about \$20,000.

The grading of the ground for the new shops of the Peoria & Eastern at Urbana, Ill., is completed and the material is being delivered preparatory to pushing the work in the early spring.

The Howard & Bulough American Machine Co., Pawtucket, R. I., have let the contract for a large extension to its present works. The new building will be 324 ft. long by 69 ft. wide, and will be erected at the end and at right angles to the present shop. This addition will be a three-story brick building and will give 67,000 sq. ft. additional floor space. The foundations are already in, the laying of the brick work will commence at once, and the buildings are to be completed by February 1, 1897. All of the special tools and machinery required have also been ordered and will be ready to be placed in the new buildings as soon as they are completed. The three-story addition will be driven and illuminated throughout by electricity.

Devenny Bros., of McKeesport, are endeavoring to secure a 10 acre site for a firm which wants to establish a steel mill at that place. The capital comes from the east. The mill will employ about 500 men if erected.

The Ohio Steel Co. started its large plant at Youngstown, O., December 1, and it is expected that it will run steadily until the holidays. It is said that an order has been received by the company for 15,000 tons of steel bil-

lets which will be used in making wire nails. The Brown-Bonnell Iron Co. and the Mahoning Valley Iron Co. will have nearly all their mills in operation during the coming week.

The new Baltimore & Ohio Railroad depot in Wheeling, W. Va., and is said to be a sure thing. Advances from headquarters of the company are to that effect. The plans for the new structure have been completed and accepted by the company, and as soon as the good weather opens up the work will commence and the building will be erected on the spot where the old one was washed out by the flood of last summer. It will be equipped with all modern improvements. The depot will cost in the neighborhood of \$100,000.

Iron and Steel.

The Penn Steel Casting & Machine Co. is busy with a large number of orders for open hearth steel castings of all kinds, including all of the steel castings for battleships 5 and 6, gun boats 7, 8 and 9, torpedo boats 3, 4, 5, 6, 7 and 8, now being built by the several ship building concerns for the United States navy.

The Franklin Steel Casting Co. has just shipped to New York, to go to Russia, on account of a large engineering company in the United States, a plunger weighing 33,000 lbs. The test on same proved the metal to be of the highest order, 73,000 tensile strength, 38,000 elastic limit, with 25 per cent elongation in 2 in. section and 21 per cent reduction of area. The company is making two large castings for the United States navy department at Washington, D. C., one of which is soon to be tested by the government, and if successful ten more are promised.

The directors of the Ohio Steel Co. have decided to increase the capital stock of the company from \$1,250,000 to \$2,000,000. It is stated that the additional \$750,000 will be used to make extensive improvements in the plant.

The Colorado Fuel & Iron Co. has sufficient pig iron on hand to last until Jan. 1, but there is quite a probability that one or more blast furnaces will be blown in within the next month. The rail mill is now at work on an order for 60 lb steel for the Colorado Midland. This will be finished this week and then 10,000 tons of 65 and 75 lb. rails will be rolled for the Gulf, Colorado & Santa Fe Railroad. This is the largest single order that the company now has. In addition some 65 lb. rails must be made for the Atlantic & Pacific and other sizes for other roads. Some 1,200 men are now daily employed in the various departments of the steel works. The merchant iron mill is running steadily as it has been for some time past. In it the 20 in., 12 in. and 9 in. mills are in operation. The spike and nut and bolt mills are also at work, and in the spike factory a double turn will probably be put on very soon. All the various shops at the mill are also in full operation. Prospects for a very active twelve-month during 1897 in all departments of the plant are said by the management to be the best. Not alone Pueblo, but various other sections of the state will profit by the opening up of the steel works, for it means the mining of more coal and iron ore, the making of more coke and activity in many directions.

Machinery and Tools.

Cahall vertical boilers, manufactured by the Aultman & Taylor Machinery Company of Mansfield, O., have recently been sold the following firm: Briar Hill Iron Company, Youngstown, O., 500 horse power; United Coke & Gas Company, McKeesport, Pa., 600 horse power; Phoenix Horseshoe Company, Poughkeepsie, N. Y., 125 horse power; Brown & Company, Wayne Iron Works, Pittsburgh, Pa., 450 horse power; Chicago Horse Shoe Company, Chicago, Ill., 250 horse power; Buffalo Furnace Company, Buffalo, N. Y., 200 horse power; Woodland Fire Brick Company, Woodland, Pa., 100 horse power; Apollo Iron & Steel Company, Apollo, Pa., (fifth order) 250 horse power; National Tube Works Company, McKeesport, Pa., (second order) 400 horse power; George Westinghouse, Jr., Pittsburgh, Pa., 100 horse power. The Carnegie Steel Company is just finishing up the installation of 6,000 horse power of these boilers at its Edgar Thomson steel works, Bradford, Pa.

The Marion (O.) Steam Shovel Company states that since the election it has booked orders amounting to \$100,000, and is now working the shops full time, and the prospects are that the company will be obliged to further increase the number of men at work, although there are at present on the pay roll very nearly 200 men.

The Betts Machine Company of Wilmington, Del., has been running full time almost all the year. The export trade this year has been very large, having sent its improved boring and turning mills, horizontal boring and drilling machines, planing machines, slotting machines, vertical drilling machines, etc., to Australia, Russia, Sweden, England, Germany, Mexico and other countries.

Alfred Box & Company of Philadelphia, have recently completed and shipped a ten ton traveling crane for the Phosphor Bronze Smelting Company, Philadelphia; a complete system of trolley trackage for the shell rooms of the United States battleship "Indiana"; also trolley trackage systems for the navy yard, Charleston, S. C., and the foundry of E. & T. Fairbanks Company, St. Johnsbury, Vt.; a 20 ton traveling crane for the New York, New Haven & Hartford Railroad, Stamford Station; a five ton traveling crane for the Steinyard Railways Company, Woodside Station, L. I., and five 5 ton jib cranes for the New York navy yard. Among the orders now in course of completion, they mention a 35 ton traveling crane for the new power house of the Liggett & Myers Tobacco Company, St. Louis, Mo.; a ten ton power traveler for the stone yards of John M. Gesslers Sons, Philadelphia, and four 6 ton traveling cranes for the Union Traction Company, Philadelphia.

Miscellaneous.

Thirteen Harveyized nickel steel armor plates, which will be used in the construction of the barbette for the United States battleship Kentucky, were recently shipped to San Francisco from Homestead, Pa., on thirteen cars specially constructed for the purpose. Each car contained one armor plate, which is 17 in. thick, 10 ft. high and 14 ft. long, and weighs 45 tons. The barbette is the largest and heaviest ever constructed, and the plates were completed in a shorter time than was ever before accomplished. The thirteen cars were rushed through to San Francisco by special train, and the plates are to be placed in the new battleship at the earliest time possible, under instruction from the secretary of the navy.

It is stated that the Chicago, Burlington & Quincy will test a new style of steel ties manufactured by A. Bidwell of New Albany, Ind. Mr. Bidwell recently received letters patent on this device.

The capacity of the New York Central freight yards at Utica, N. Y., is to be enlarged from 900 to 1,200 cars, involving an outlay of at least \$25,000. The present location of the passenger tracks will be changed as a result of the improvement. Utica has become a good deal more of a freight center during the last few years, particularly because of the greatly increased traffic on the Mohawk and Malone.

A contract has been closed by Andrew Carnegie for the construction of a big ore and coal loading plant at Conneaut, O., and extensive docks will also be built there. Conneaut is the northern terminus of Carnegie's railroad, the Pittsburgh, Shenango & Lake Erie. It is stated that Mr. Carnegie has a contract with Mr. John D. Rockefeller covering several years for the delivery of ore from the latter's Lake Superior mines at the docks in Conneaut.

The Manhattan Elevated Railroad officials are preparing to experiment with petroleum as fuel for motive power under a new system on their lines in New York City. The work of fitting a locomotive for the new system has been begun and it is expected that tests will be made next week by J. S. Zerbe, secretary and chief engineer of the Consolidated Gas Fuel Co. of New York, the inventor of the system.

The United States government has taken steps toward the improvement of the jetties at the mouth of the St. Johns river. The war department is now inviting sealed proposals for delivering 30,000 tons of granite or other durable rock upon the jetties. The bids will be opened at the office of W. H. H. Benyaurd, lieutenant-colonel of the U. S. engineers, at St. Augustine, Fla., on Dec. 26.

The Damascus Bronze Co. of Pittsburgh, Pa., has received several large orders, and has placed the plant working in full. It is now running about 10,000 to 12,000 lbs. per day, and hopes by the first of the year to increase the output. The board of directors has authorized the building of a new office not to exceed in cost \$2,500.

It is reported that the Lookout Mountain Railroad Co., controlling what is known as the Broad Gauge Line, to the top of Lookout Mountain, in the suburbs, will substitute the trolley system for steam on its road.

A new steel pier to cost \$150,000 is to be built at Atlantic City before the opening of next season, according to reports. It will extend 2,500 ft. from the esplanade in the vicinity of Pennsylvania avenue.

The plant of the Litchfield Car & Machine Co., at Litchfield, Ill., was sold by Master in Chancery Howett at the court house in Hillsboro, Ill., on November 21 for \$50,000. It was purchased M. M. Martin & Co. at Litchfield, and the Mechanics Bank of St. Louis.

The Louisville & Nashville Co. has determined to enlarge its freight yards at Pensacola, Fla., and it is reported, has purchased 100 acres of land for the construction of sidings, etc.

The American Steel Barge Co., West Superior, Minn., is to build the largest whaleback steamer yet attempted, which will be named the Alexander McDougall.

Bids are asked until December 12 for furnishing and constructing about seven miles of 5-strand barbed wire fence with cedar posts and 1½ in. black iron pipe top rail around the military reservation at Fort Harrison, Mont. Address Captain F. B. Jones, Asst. Q. M., Helena, Mont.

The St. Joseph Valley Railroad, which is to be built from Benton Harbor, Mich., to Buchanan, has purchased the Fontaine mill property and other land for a terminal, paying \$40,000 therefor.

The contract for the remaining ten miles of the Butler & Pittsburgh Railroad has been awarded to Rogers, Heggeman & Co. of New York, at a price approximating \$600,000, it is stated. The contract includes considerable rock and tunnel work, masonry viaducts, culverts, etc.

The Japanese government has, according to a Reuter's telegram, given contracts to a firm at Philadelphia and another at San Francisco for each to build a cruiser of the exact type of the United States cruiser Olympian, which has a displacement of 5,500 tons.

At a meeting of the executive committee of the Manhattan Railway Co. on Dec. 1 it was decided to equip the cars on the elevated railroads with the Pintsch gas light system. This system is used on the Broadway cable cars and on many of the important steam railroad lines. President George J. Gould, of the Manhattan Railway, said in regard to the decision of the executive committee; "After a thorough investigation I was convinced that the Pintsch system was the best, and we have adopted it for that reason. I have signed the contract for the equipment of all the cars on our lines with the light, and the work is to be rushed as rapidly as possible."